

# Stormwater Capacity Analysis for Holmes Run Watershed, City of Alexandria, Virginia

PREPARED FOR: City of Alexandria Transportation & Environmental Services Department  
PREPARED BY: CH2M HILL  
DATE: February 2016  
PROJECT NUMBER: 240027

## Contents

Contents .....	1
Executive Summary .....	1
Project Introduction .....	2
Task 2 Objective .....	5
Description of Existing Stormwater Collection System.....	5
Public/Private and Disconnected Drainage Systems .....	5
Modeled and Analyzed System.....	6
Data Gaps.....	9
Modeling Approach .....	10
Hydrologic Modeling.....	10
Simulation of Stormwater Runoff.....	13
Hydraulic Modeling.....	13
Model Results .....	14
Hydrologic Model Results .....	14
Inlet Capacity Results .....	14
Hydraulic Model Results .....	14
Summary .....	19
References .....	19

## Attachments

- A     Methodology for Identifying Public vs. Private Structures: August 6, 2009, Meeting Summary
- B     Hydrologic Model Schematic and Parameters
- C     Detailed Inlet Capacity Results
- D     Detailed Model Results

## Executive Summary

The City of Alexandria, Virginia, has experienced repeated and increasingly frequent flooding events attributable to old infrastructure, inconsistent design criteria, and perhaps climate change. The purpose of the stormwater capacity analysis project is to provide a program for analyzing storm sewer capacity issues, identifying problem areas, developing and prioritizing solutions, and providing support for public outreach and education. The project is being implemented in phases by watershed. The watersheds include Holmes Run, Hooffs Run, Four Mile Run, Cameron Run, Taylor Run, Strawberry Run, Potomac River, and Backlick Run.

This technical memorandum focuses on hydrologic and hydraulic analyses of Holmes Run watershed using xpswmm. It summarizes the storm sewer system in the Holmes Run watershed, the model development steps, data sources and gaps, model assumptions, and the results, focusing on the capacity deficiencies

identified in the model. These deficiencies will be used as a basis for identifying and prioritizing problem areas and solutions during the next phase of the project.

The objective of this phase of the study is to identify the deficient stormwater collection system elements in Holmes Run during a 10-year return period rainfall storm event. During the Hooffs Run watershed modeling task, three different design storm scenarios and one historic event were investigated: the City's existing intensity-duration-frequency (IDF) curve, the updated curve using the full record of historical precipitation data (1949 to 2008), and the curve projected for the year 2100 using various climate change scenarios and the June 25–27, 2006 storm event. The results from the Hooffs Run modeling analyses showed that the existing IDF design hyetograph was the most conservative of the design storms (produced the greatest amount of stormwater runoff and flooding), and produced a similar amount of the system flooding to the results from the historic event. Consequently, this scenario was chosen to be used to complete the stormwater capacity analysis for the other watersheds.

The Holmes Run watershed has a drainage area of 2.88 square miles located in the northwestern corner of the city, bounded to the north and west by Fairfax County, to the south by Backlick Run, and to the east by Four Mile Run and Cameron Run North. The watershed is drained by Holmes Run and its tributaries from north to south and discharges into Cameron Run near Ben Brenman Park. The Holmes Run storm sewer system model is composed of 1,778 and 1,747 modeled nodes and conduits, respectively.

The hydraulic model predicts that approximately half of the pipes in Holmes Run are experiencing capacity deficiencies, primarily in the lower half of the watershed. The model results show that 18 percent of the pipes flood the ground surface, 16 percent have a hydraulic grade line within two feet of the surface, and 19 percent surcharge above the crown of the pipe. Comparing the peak runoff to the estimated inlet capacity of each catchment indicates that 44 percent of the catchments in the model may have insufficient inlet capacity. Maps and profiles of flooding areas are presented in this technical memorandum to assist in locating problem areas and understanding the capacity deficiencies of the drainage system.

The hydraulic modeling results presented in this memorandum should be reviewed with the understanding that several assumptions were made to fill data gaps, primarily assumptions of inverts in pipes with diameters less than 24 inches.

## Project Introduction

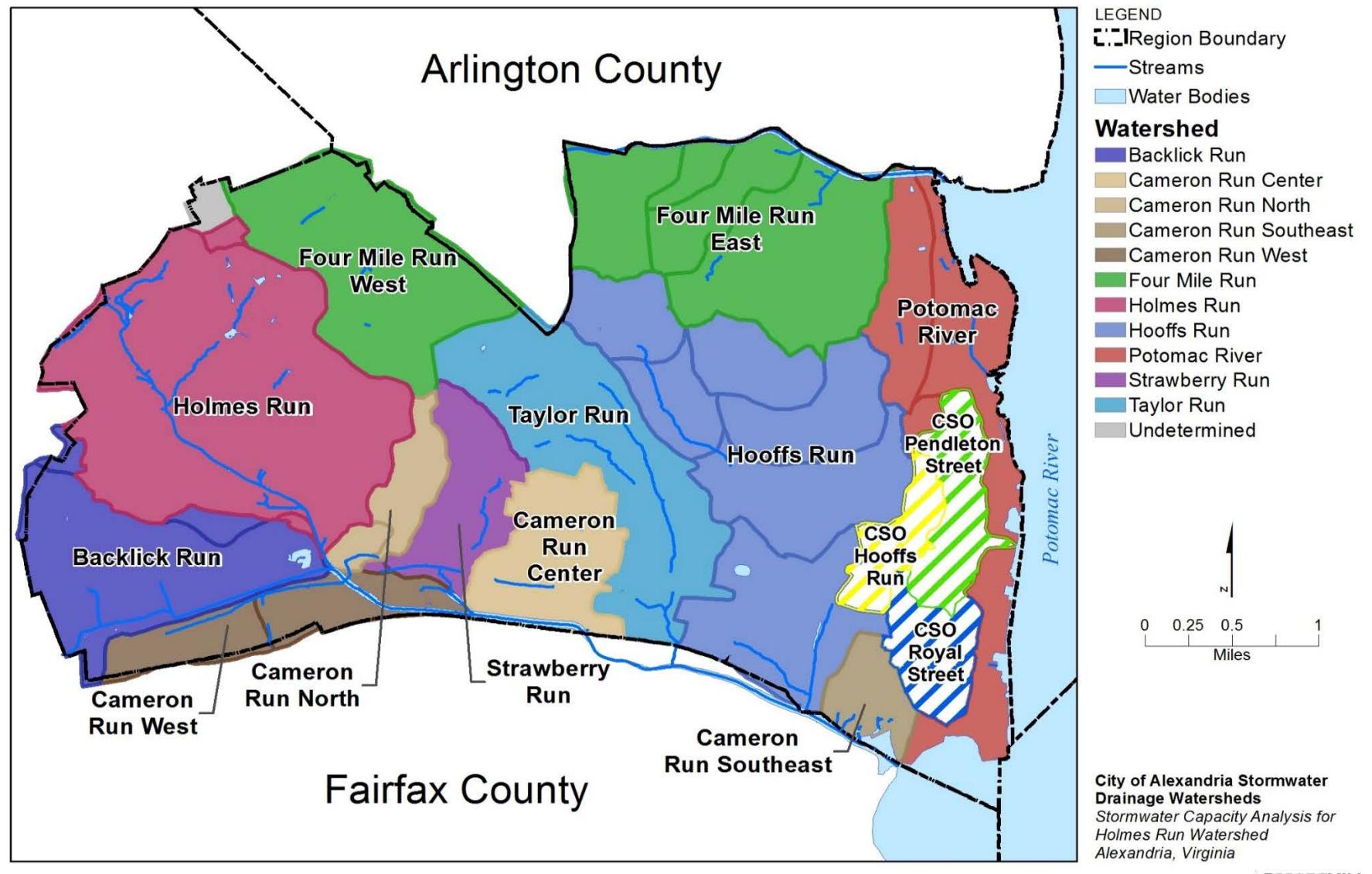
The City of Alexandria, Virginia, (City) has experienced repeated and increasingly frequent flooding events attributable to old infrastructure, inconsistent design criteria, and perhaps climate change. The purpose of this project is to provide a program for analyzing storm sewer capacity issues, identifying problem areas, developing and prioritizing solutions, and providing support for public outreach and education. The project is being implemented in phases by watershed. The watersheds include Hoofs Run, Four Mile Run, Holmes Run, Cameron Run, Taylor Run, Strawberry Run, Potomac River, and Backlick Run.

The purpose of this task is to conduct stormwater capacity analysis for the City's existing stormwater collection system, located in the Holmes Run watershed. Figure 1 presents the various drainage watersheds for the City of Alexandria.

This technical memorandum describes the methodology and results of the stormwater capacity analysis for the stormwater collection system in the Holmes Run watershed identified in Figure 1. Subsequent memorandums will describe the results for remaining watersheds in the City.

FIGURE 1

Stormwater Drainage Watersheds, City of Alexandria, Virginia  
*City of Alexandria Storm Sewer Capacity Analysis – Holmes Run*





## Task 2 Objective

The objective of this phase of the study is to identify the deficient stormwater collection system elements during a 10-year return period storm event.

The stormwater collection system elements include the following:

Closed conduits, such as gravity mains (storm drains) and culverts

Open channels, such as streams and trapezoidal channels that connect two pipe systems

Drainage inlets and junctions, such as roadside curb inlets, manholes, catch basins, and ponds

Flow-regulating structures, such as weirs, orifices, and tide gates (if any)

## Description of Existing Stormwater Collection System

The City maintains a geodatabase of all stormwater collection system elements, including conduits and drainage junction points. The City provided CH2M HILL with a checked-out copy of the Holmes Run geodatabase on October 24, 2012 to use as the basis of the stormwater collection system model. The geodatabase was thoroughly reviewed and updated with new survey data collected during Task 3, Field Survey and Condition Assessment, and, in some locations, with information available on the City's plan and as-built drawings to improve data quality and system connectivity. The updated database was returned to the City (i.e. checked-in) for incorporation into the City-wide stormwater collection system geodatabase. The updated stormwater collection system in the Holmes Run watershed contains the following elements:

- 161,167 linear feet of gravity mains (storm drains) represented by 2,028 pipes. Pipe diameter/height varies from 6 to 114 inches for circular, rectangular, elliptical, and arch pipes.
- 2,159 drainage junction points:
  - 7 catch basins
  - 14 culvert points
  - 1,463 drainage inlets
  - 441 manholes
  - 138 nodes (blind connections)
  - 90 pipe inlet/outlets
  - 3 control devices
  - 3 storage basins (stormwater ponds)

In addition to the structures represented in the stormwater collection system geodatabase, several natural streams and open channels convey storm flows in the City's drainage network. These streams are documented separately in the City's GIS data in a stream layer. Holmes Run has only three well defined tributaries or streams within the watershed. All of the streams are hydraulically connected directly to Holmes Run and the storm sewer systems are connected directly to the tributaries or to Holmes Run. Therefore no streams are modeled as part of the Holmes Run stormwater capacity analysis.

## Public/Private and Disconnected Drainage Systems

The City's geodatabase includes structures that are privately owned. Since the hydraulic analyses and identification of capacity deficiencies include only the public facilities as per direction from the City, the structures located in privately owned parcels were identified and excluded from the model. The methodology that was used to accomplish this is documented in the meeting minutes presented in Attachment A.

Small disconnected drainage systems were also identified and excluded from the model database due to lack of accurate information to connect them to the main drainage system. Despite survey and review of available drawings and documents, small isolated systems remained in the database. These systems were identified

and removed from the model. These systems consisted of only a few structures and did not connect to any larger downstream systems.

## Modeled and Analyzed System

After reviewing and updating data in the City's geodatabase, the database was returned to the City and a copy of that geodatabase was used as the starting point for the hydraulic model. After removing the private systems and small isolated systems the remaining structures were included in the hydraulic model.

The scope includes only an analysis of approximately 20 percent of the inlets, so flow was frequently loaded downstream of the most upstream pipe. Therefore 904 pipes with diameters of 6 to 24 inches, 20 pipes with diameters of 30 to 48 inches, and one pipe 114 inches in diameter<sup>1</sup> in the upstream-most portions of the system were effectively eliminated from the analysis. Only results pertaining to the analyzed system are included in this report. The analyzed system contains the following elements:

- 98,019 linear feet of gravity mains (storm drains) represented by 822 pipes.<sup>2</sup> Pipe diameter/height varies from 8 to 72 inches for circular, rectangular, elliptical, and arch pipes.
- 855 drainage junction points:
  - 452 drainage inlets
  - 318 manholes
  - 42 nodes (blind connections)
  - 41 pipe inlet/outlets
  - 2 control device
  - 2 storage basin (stormwater pond)

Figure 2 is a geographic schematic of the stormwater collection system in the Holmes Run watershed. There is a small system in the southern most portion of the watershed that discharges to the Holmes Run mainstem but was included in the Strawberry Run model. This drainage area is included in maps in this report as subwatershed 5.

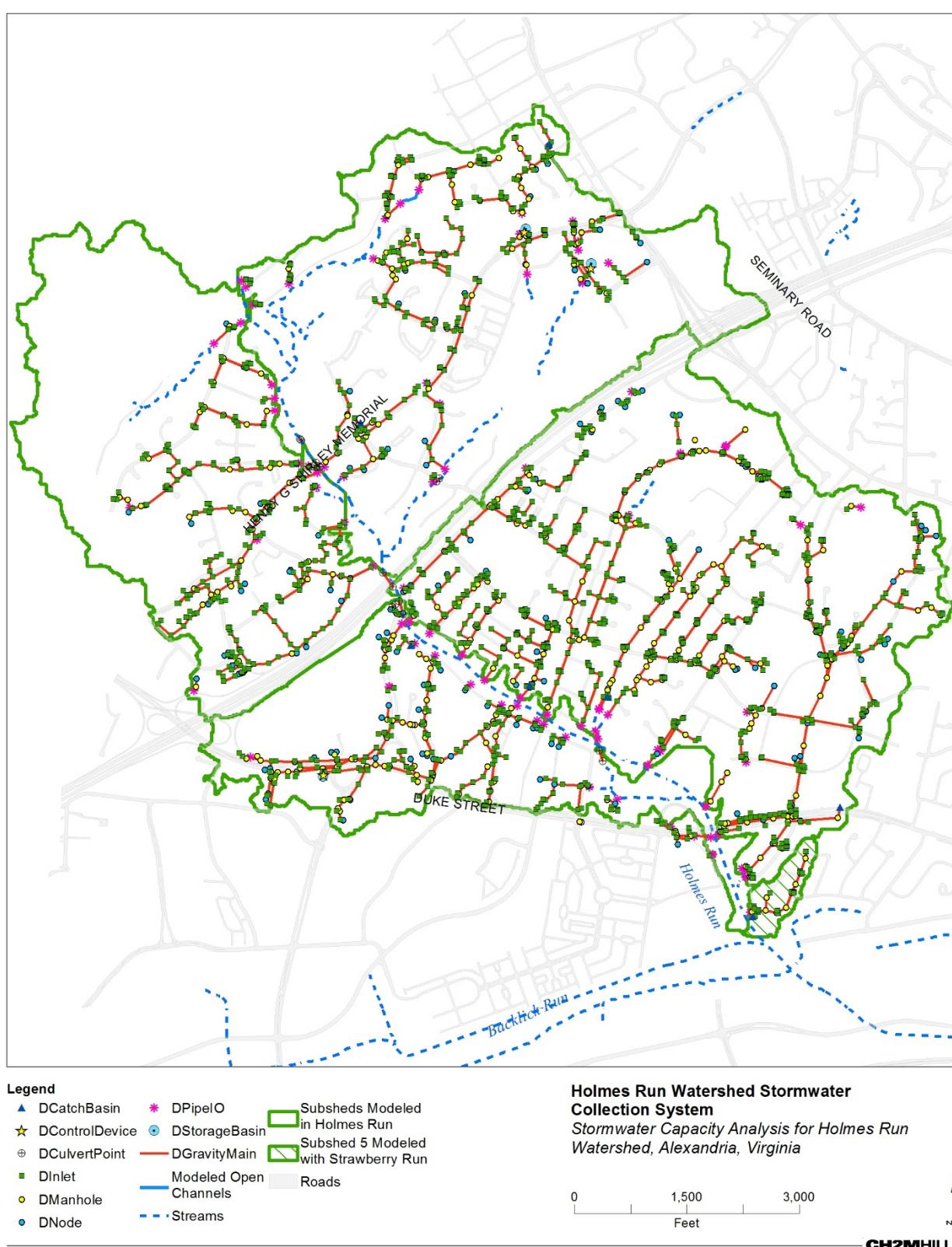
---

<sup>1</sup> The GIS and field investigations identified a 114" diameter pipe in the parking lot of the Alexandria Hospital, located on Howard Road south of Seminary Road. The pipe does not appear to have significant drainage area and no further information could be obtained, therefore it was not included in the model, however it does have the potential to provide storage in this area if drainage is routed to it.

<sup>2</sup> Five pipe segments are double barrels represented by a single pipe segment in the model and the geodatabase

FIGURE 2

Existing Stormwater Collection System, Pilot Watershed  
*City of Alexandria Storm Sewer Capacity Analysis – Holmes Run*



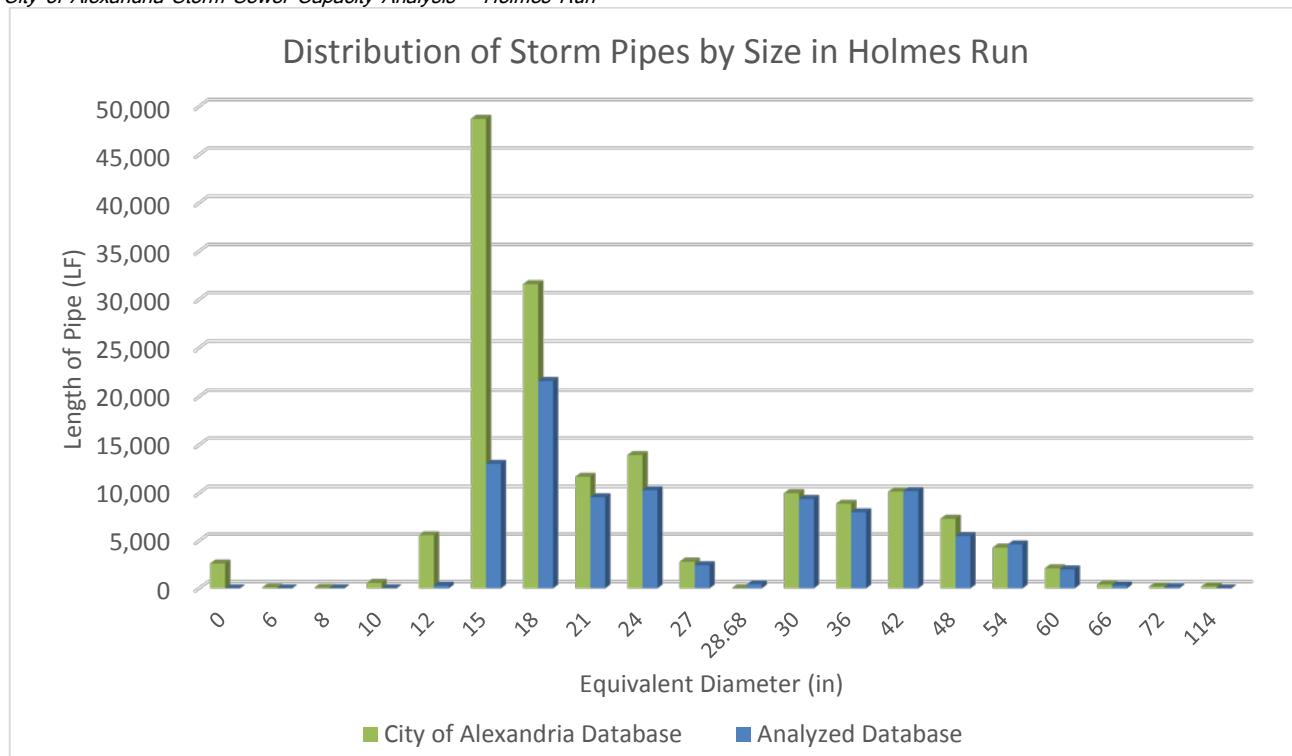


The distribution of storm drains in the City's Holmes Run geodatabase and the storm drains analyzed in the Holmes Run model by size are presented in Figure 3.

FIGURE 3

Distribution of Storm Drains by Size

City of Alexandria Storm Sewer Capacity Analysis – Holmes Run



## Data Gaps

The available data for the storm drains in the Holmes Run watershed were evaluated for data quality and completeness. Structures connected to pipes that were less than 24 inches were not surveyed. About 60 percent of the total linear footage of pipes in the modeled Holmes Run watershed database, which does not include private or disconnected structures, are less than 24 inches in size (including pipes with unknown diameter). In addition, there were instances where structures could not be found, were inaccessible, or where lid covers were secured. Data was also missing in locations with blind pipe connections with no access manhole. As a result, the filling of numerous data gaps was required in order to develop a complete model.

The following approaches were adopted to fill in the missing data:

- Missing data were inferred from the available data, if applicable. For example, a missing pipe size was assumed to equal the downstream pipe diameter.
- Pipe diameters at the most-upstream inlets were assumed to be 12 inches.
- A 6-inch-depth to crown was assumed for the most upstream inlets and DNodes.
- Interior point feature invert elevations were estimated by assuming that pipe slope is constant.
- Limited data available in the GIS for ponds and the outlet control structures were supplemented with data from as-built plans.

In addition to filling in missing data, CH2M HILL reviewed the data for quality and validity. Assumptions were made when the available data were not reasonable (e.g., a pipe crown was above the rim of a manhole). Additional information regarding the types of assumptions made to complete the Hooffs Run watershed hydraulic model is provided in Attachment B. Similar assumptions were made for the Holmes Run analysis.

## Modeling Approach

The Holmes Run watershed was analyzed using commercially available and public domain computer models that are widely used and industry accepted. The public domain software ArcHydro Tools (version 1.4) and HEC-GeoHMS (version 5.0) were used to aid in the delineation of subwatersheds and to estimate hydrologic parameters, such as drainage areas, basin slope, and basin width. Other hydrologic parameters, including catchment width and percent impervious area, were estimated in ArcGIS after the catchment delineation was completed. The widely used and industry-accepted private domain stormwater management software xpswmm (version 2011 SP1a) was used to simulate natural rainfall-runoff processes and the performance of the stormwater collection system.

The City provided the following required data:

- HolmesRun\_Dsewer\_CH2MHill\_112211.gdb, a checked-out copy of the Holmes Run geodatabase of the stormwater collection system
- Spring 2008 DVD, City GIS data (shapefiles and orthophotography) such as topographic data and land use
- Spring 2011 DVD, City GIS data (geodatabase and orthophotography) such as topographic data and land use

SewerData\_032613.gdb, City Wide Sewer Data (geodatabase) updated geodatabase of the City's stormwater collection system

In addition, Fairfax County provided FairfaxStormwaterData12122011.gdb, a geodatabase of the stormwater collection system and FairfaxPlanimetricData12122011.gdb, a geodatabase of planimetric data.

## Hydrologic Modeling

The hydrologic modeling required two major types of inputs:

**Hydrologic parameters:** Delineation of subwatersheds and computation of hydrologic parameters such as drainage areas, basin slope, basin width, percent impervious, and infiltration inputs for each subwatershed

**Design hyetographs:** determination of 24 hours of synthetic rainfall distribution for the 10-year design storm event

### Hydrologic Parameters

Hydrologic parameters were estimated using ArcHydro Tools 9 (version 1.4, January 5, 2011) and the ArcGIS version of HEC-GeoHMS.

ArcHydro Tools is a set of public domain utilities developed jointly by the Center for Research in Water Resources, of the University of Texas at Austin (<http://www.crwr.utexas.edu>), and the Environmental Systems Research Institute, Inc. (ESRI). These tools provide functionalities for terrain processing, watershed delineation, and attribute management. They operate on top of the ArcHydro data model in the ArcGIS environments. The model uses the digital elevation model (DEM) for the subject watershed to compute the hydrologic parameters and delineate catchments. The “burning in” technique allows the user to impose the drainage system on the terrain to better produce the catchment boundaries.

HEC-GeoHMS is geospatial hydrologic modeling software developed and maintained by the USACE's Hydrologic Engineering Center (HEC). The model allows users to visualize spatial information, perform spatial analysis, delineate subbasins, and estimate watershed hydrologic parameters (USACE, 2003).

In this study, 2-foot contour data provided by the City were used to create a DEM of the watershed. ArcHydro Tools were used to delineate the catchments (also referred to as subbasins in ArcHydro Tools). HEC-GeoHMS was used to compute hydrologic parameters such as drainage area, slope, and longest flow path for each catchment. Width was derived using the catchment drainage area and longest flow path using the equation width = (area/longest flow path). Percent impervious was estimated in ArcGIS using the

delineated catchments and impervious shapefiles provided by the City, which included roads, driveways, parking lots, and sidewalks.

For catchments that extended outside of the City, data was obtained from Arlington and Fairfax Counties to calculate the necessary hydrologic parameters.

A schematic of the hydrologic model for the Holmes Run watershed is presented in Attachment B. The schematic model shows the catchment ID, delineated boundaries, longest flow path, and drainage inlets for each catchment. It also presents the DEM for the watershed. The elevation varies from 10 to 288 feet North American Vertical Datum 1988. The hydrologic parameters for each catchment are presented in Attachment B. The following are the major drainage characteristics for the Holmes Run watershed:

- Total drainage area is 2.88 square miles (1,840 acres)
- Area divided into 5 subwatersheds containing 567 catchments, 84 of which drain directly to Holmes Run as shown in Attachment B
- 39 percent of the drainage area is impervious
- Average catchment area is 3.25 acres
- Average catchment slope is 0.09 feet/foot
- Average catchment width is 193 feet

### Design Hyetographs

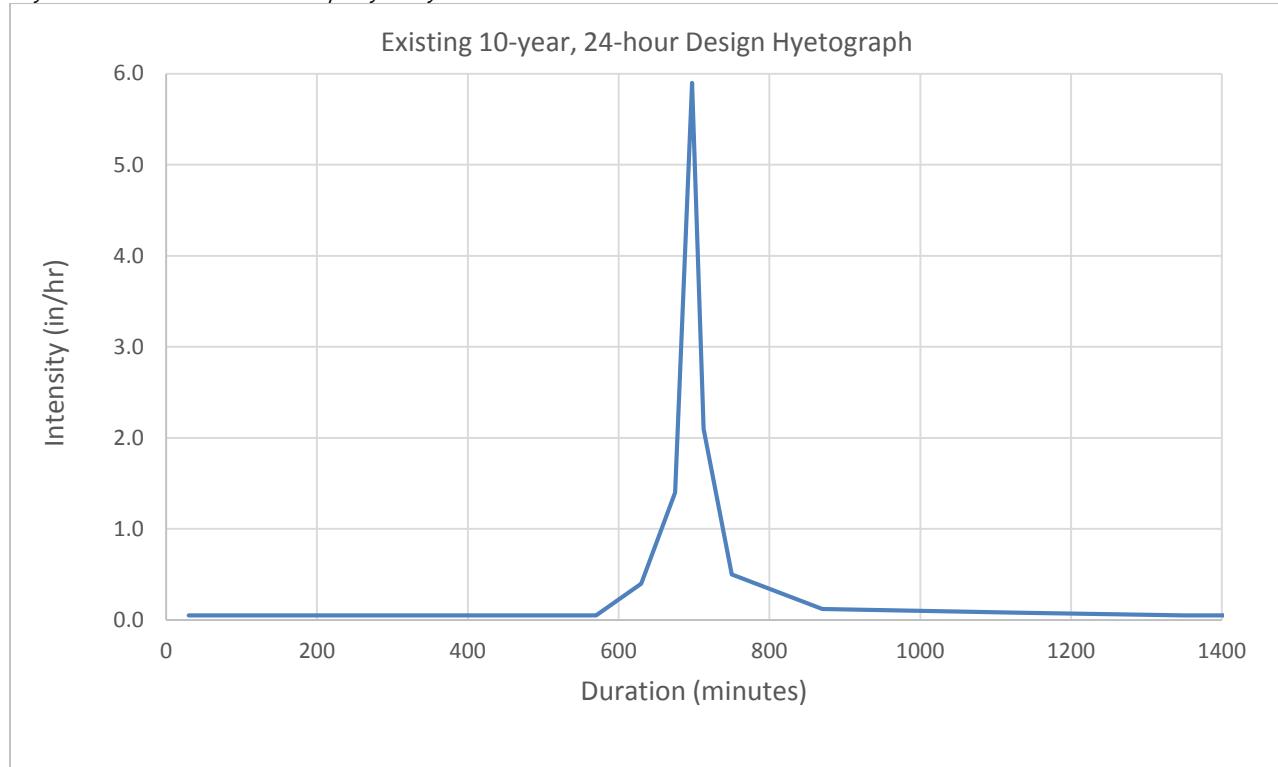
The 24-hour synthetic rainfall distribution for the 10-year design storm event was developed based on rainfall data from the existing intensity-duration-frequency (IDF) curve for the 10-year return period for Alexandria (City of Alexandria, 1989). Time of concentration values were computed for several inlets in the Hooffs Run pilot subwatershed and the FMR priority subwatershed. Based on these results, the peak rainfall intensity was selected from the IDF curve, based on a 15-minute time of concentration. A variable time interval approach was used to generate the design hyetograph. The design hyetograph was developed to yield maximum rainfall intensity at the approximate center of the 24-hour storm. The 24-hour rainfall total is 5.04 inches, and the peak intensity is 5.9 in./hr. Table 1 and Figure 4 present the existing 10-year, 24-hour design hyetograph.

TABLE 1

**Existing 10-year 24-hour Design Hyetograph Data***City of Alexandria Storm Sewer Capacity Analysis – Holmes Run*

Start Time (minutes)	Duration (minutes)	Absolute Rainfall Depth (inches)	Intensity (in/hr)
0	60	0.05	0.05
60	60	0.05	0.05
120	60	0.05	0.05
180	60	0.05	0.05
240	60	0.05	0.05
300	60	0.05	0.05
360	60	0.05	0.05
420	60	0.05	0.05
480	60	0.05	0.05
540	60	0.05	0.05
600	60	0.40	0.40
660	30	0.70	1.40
690	15	1.475	5.90
705	15	0.525	2.10
720	60	0.50	0.50
780	180	0.36	0.12
960	360	0.48	0.08
1320	60	0.05	0.05
1380	60	0.05	0.05

FIGURE 4

**Existing 10-Year 24-Hour Design Hyetograph***City of Alexandria Storm Sewer Capacity Analysis – Holmes Run*

## Simulation of Stormwater Runoff

The xpswmm 2012 software was used to simulate rainfall-runoff processes from the Holmes Run watershed. The hydrologic parameters such as area, slope, width, and percent impervious for each of the 566 catchments were estimated using ArcGIS, ArcHydro Tools 9, and ArcGIS version of HEC-GeoHMS, as described earlier. These hydrologic parameters were used as input to the RUNOFF module of the xpswmm model. The design hyetograph for the 10-year return period was also used as input to the RUNOFF module. The U.S. Environmental Protection Agency (USEPA) SWMM Runoff Non-linear Reservoir Method was used to simulate the stormwater runoff from each catchment in response to the hyetograph.

## Hydraulic Modeling

The xpswmm model was used to simulate the hydraulic performance of the stormwater collection system during a 10-year design storm event. Model input data included the following physical data:

- Junctions (inlet, manhole, nodes, etc.), such as invert and rim elevations
- Closed and open conduits (e.g., pipes and streams) such as invert elevations, size, shape, material, and length
- Stormwater storage ponds, such as stage-storage relationships
- Control devices (orifices, weirs, etc.)

The stormwater collection system data found in the geodatabase provided by the City was used as the basis for the model, with the survey data (see page 9, *Data Gaps*) filling in the gaps where applicable. The geodatabase was subsequently updated with the survey data for most publicly-owned pipes with diameters/heights greater than or equal to 24 inches and the structures (manholes, inlets, etc.) attached to them. Private structures were not modeled, so any runoff from private property was applied to the same structure as the runoff from the public property within the catchment. All elevations (invert and rim) recorded in the geodatabase of the stormwater collection system are in NAVD 88 datum; therefore the xpswmm model was built in NAVD 88.

Entrance or exit loss coefficients were applied to pipes at connections where pipe size significantly increased or decreased. An exit loss coefficient of 0.15 was applied to the smaller (upstream) pipe where the downstream pipe was 2 or more times the size of the upstream pipe. An entrance loss coefficient of 0.1 was applied to the smaller (downstream) pipe where the downstream pipe was half the size, or smaller, of the upstream pipe.

The stream channels were not included in the model for Holmes Run. There were a total of 36 outfalls; each representing a small upstream storm sewer system and each was assumed to have a free outfall downstream boundary condition. This was considered to be appropriate since the area draining to each outfall was less than 60 percent of the total drainage area to that point in the stream channel; hence the peak of the small systems are not coincident with the peak in the stream channel. In addition, the invert of the outfalls were checked against the topography at the outfall locations to confirm the outfalls were elevated above baseflow.

The City provided plan drawings for the Mark Center Office Park and the Radisson Mark Plaza. These plans included stage storage and outlet control information for two ponds along Beauregard Street west of Seminary Road. The elevation data available for the ponds, is in NGVD29, and therefore a conversion to NAVD88 was required before importing storage data into xpswmm. A conversion factor was determined for the ponds using the free and publicly available VERTCON program provided by the National Geodetic Survey.

The primary objective of the hydraulic modeling was to analyze pipe capacities. Hydrographs from the RUNOFF module were entered directly into the underground storm sewer system. This approach does not model the flow restrictions caused by the surface inlets. Due to modeling software and data limitations, inlet capacity cannot be readily modeled in xpswmm and is instead being evaluated in a separate spreadsheet.

The flow directly entering the collection system provides a conservative or “worst case” evaluation of pipe capacities. The details of the model limitations encountered during this study and the external spreadsheet evaluation are provided in *Inlet Capacity Analysis for City of Alexandria Storm Sewer Capacity Analysis* (CH2M HILL, 2012a).

## Model Results

Model results are summarized in the following sections.

### Hydrologic Model Results

Peak discharge for each node where overland flow was loaded into the hydraulic model is provided in Attachment C.

### Inlet Capacity Results

Inlet capacity was evaluated outside xpswmm due to limitations in the modeling software’s capabilities. Details on the evaluation of the options for modeling inlet capacity are provided in *Inlet Capacity Analysis for City of Alexandria Storm Sewer Capacity Analysis* (CH2M HILL, 2012a), which was provided to the City in September 2012. The spreadsheet evaluation multiplies the maximum capacity of a single inlet, estimated to be 3.25 cfs based on an assumed standard gutter spread and road cross-section, by the total number of catch basins and inlets within the catchment assigned to a single runoff input point, the location where overland flow was plugged into the hydraulic model. The model has flow loaded into 414 locations with an average of 3 inlets per runoff input point. The estimated capacity for each load point was compared to the peak runoff generated in the RUNOFF module of xpswmm to determine whether the catchment has sufficient inlet capacity. Results suggest that about 44 percent of the model load points, representing about 53 percent of the Holmes Run drainage area, may be experiencing inlet capacity limitations.

The total inlets and catch basins count is based on the City’s GIS data for Holmes Run, including all available private and disconnected inlets and catch basins. Private structures are not always included in survey efforts; therefore many private inlets and catch basins may not be accounted for in the City’s geodatabase, which would effectively undervalue the City’s available inlet capacity in this analysis. Approximately 18.5% of the catchments analyzed in the model do not have any inlets or catch basins, either because the systems were privately owned, drained overland, or inlets were not mapped. Given limited information on these catchments they were assumed to have sufficient capacity. Inlet capacity results are presented in Attachment C.

### Hydraulic Model Results

Model results for the pipes and stream segments are summarized in the following sections. Detailed results are presented in Attachment D.

#### Pipe Capacity

The conveyance capacity of the existing stormwater collection system was evaluated based on three evaluation criteria, listed in order of decreasing severity:

If the hydraulic grade line (HGL) rose above the ground surface, the structure was considered flooded.

If the HGL rose above the crown of the pipe to within 2 feet of the ground surface, the structure was considered to have insufficient freeboard.

If the HGL rose above the crown of the pipe, but not within 2 feet of the ground surface, the structure was considered surcharged.

Pipes were evaluated for these conditions based on the upstream end and categorized based on the least desirable condition, flooding being the least desirable. In some cases the water surface was within 2 feet of the ground surface, but within the pipe (not surcharging), because the crown of the pipe was less than 2 feet from the ground surface. In those cases, the pipes were not included in the “insufficient freeboard” category.

Additional details on the results are presented in the following section. The pipes with flooded, insufficient freeboard and surcharged conditions are summarized in Tables 2 and 3. A plan view of the Holmes Run watershed is provided in Figure 5, depicting the pipes experiencing flooding, insufficient freeboard, and surcharged conditions. Profiles which display the conditions of the pipes along the main storm sewer line within the Holmes Run watershed can be found in Attachment D.

The example profiles display the following:

- Vertical cross-sectional view of the conduits, including the invert and crowns
- Water surface elevation in the conduit (i.e., HGL)
- HGL in junctions such as manholes, inlets, and nodes
- HGL above the conduit crown (surcharged conditions)
- HGL above the ground (flooding)

Note that the profiles presented only show a snapshot of the system during the model simulation. These profiles will not always show the most severe flooding at each location. For example, the profile may not show the flooding symbol at a location even though surface flooding does occur either before or after the snapshot of the profile was taken.

The detailed model results are presented in tabular format in Attachment D. The results presented in this memorandum should be reviewed with the understanding that flow data were not available for model calibration, and several assumptions were made to fill data gaps, primarily assumptions about pipe invert where survey data were unavailable.

The model results presented in Table 2 show that 18 percent of the pipes flood the ground surface, 16 percent have a hydraulic grade line within 2 feet of the surface, and 19 percent surcharge above the crown of the pipe.

### **Stream Results**

Holmes Run has only a handful of streams within the watershed. All of the streams are hydraulically connected directly to Holmes Run without any conveyance via a public storm sewer system. Therefore no streams are modeled as part of the Holmes Run stormwater capacity analysis.

TABLE 2

**Watershed Modeling Results, Summarized by Pipe Size***City of Alexandria Storm Sewer Capacity Analysis – Holmes Run*

Equivalent Pipe Diameter	Sufficient Capacity			Surcharged			Insufficient Freeboard			Flooded		
	Count	Length (LF)	Percent of Total Length	Count	Length (LF)	Percent of Total Length	Count	Length (LF)	Percent of Total Length	Count	Length (LF)	Percent of Total Length
Less than 2.0 feet	168	17,984	18%	65	6,947	7%	74	8,154	8%	95	11,461	12%
2.0 to 2.75 feet	96	11,202	11%	38	5,047	5%	23	3,095	3%	23	3,217	3%
3.0 to 4.9 feet	134	16,130	16%	50	6,187	6%	19	2,998	3%	16	3,118	3%
5.0 to 13.2 feet	13	1,147	1%	0	0	0%	6	1,035	1%	2	297	0%
<b>Total</b>	<b>411</b>	<b>46,462</b>	<b>47%</b>	<b>153</b>	<b>18,181</b>	<b>19%</b>	<b>122</b>	<b>15,282</b>	<b>16%</b>	<b>136</b>	<b>18,093</b>	<b>18%</b>

Note: Table does not include pipes upstream of hydrologic load points in the model

Results are based on results at upstream end of pipe

ft = feet

LF = linear feet

TABLE 3

**Watershed Model Results, Summary by Capacity***City of Alexandria Storm Sewer Capacity Analysis – Holmes Run*

	Conduit Count	Conduit Length (LF)	Percent of Total Length	Duration (hrs)				Volume (ft <sup>3</sup> ) <sup>a</sup>			
				Max	Min	Avg	Total	Max	Min	Avg	Total
Sufficient Capacity	411	46,462	47%	-	-	-	-	-	-	-	-
Surcharged <sup>b</sup>	153	18,181	19%	55.1	0.1	0.7	255	-	-	-	-
Insufficient Freeboard	122	15,282	16%	-	-	-	-	-	-	-	-
Flooded	136	18,093	18%	6.1	0.0	0.7	92	197,263	1.02	6,623	900,744

<sup>a</sup> Flooded volume<sup>b</sup> Duration of surcharged flow includes time during which conduits have insufficient freeboard or are flooded at the upstream end.ft<sup>3</sup> = cubic feet

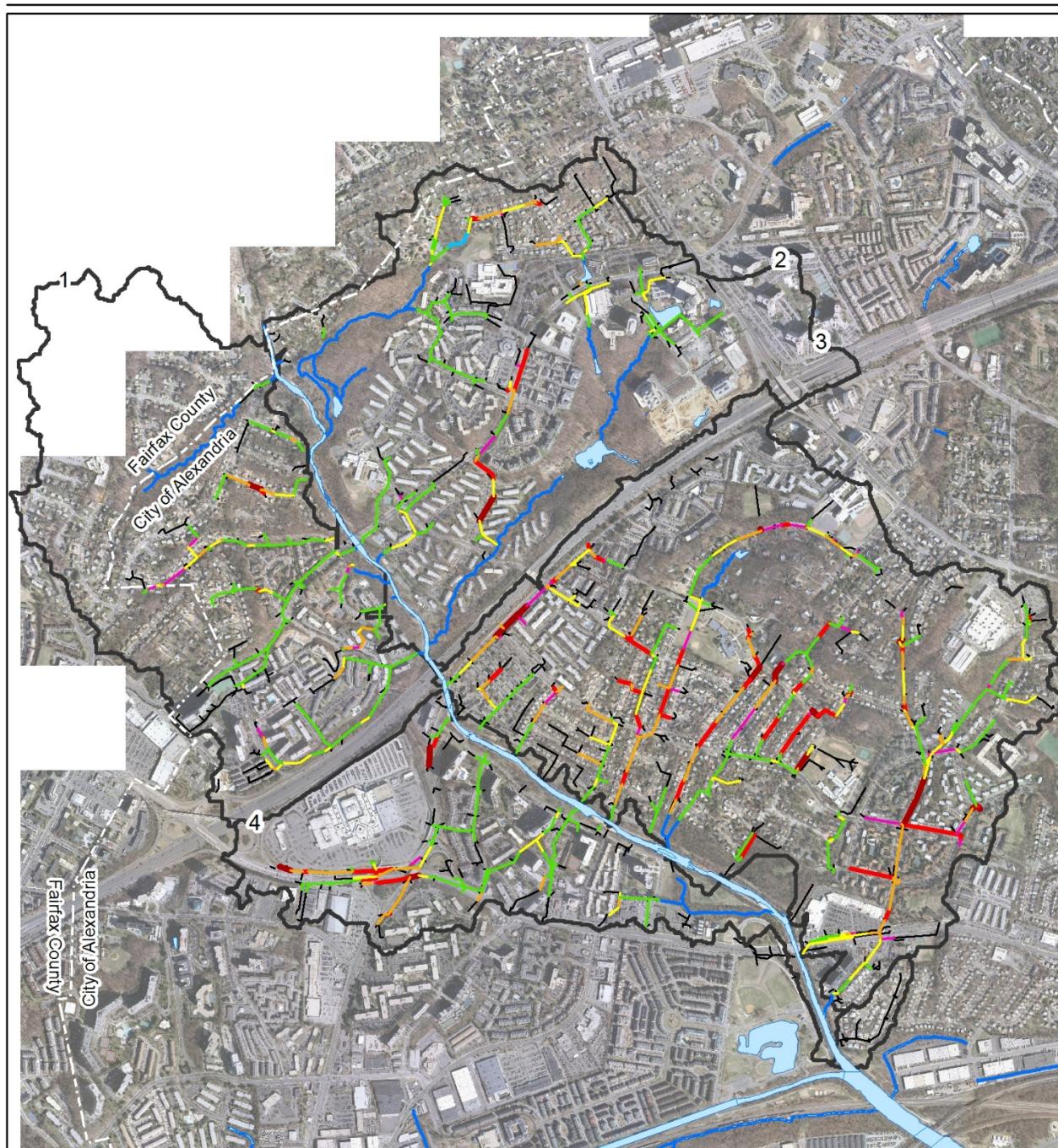
hr = hour

LF = linear feet

FIGURE 5

## Watershed Modeling Results

City of Alexandria Storm Sewer Capacity Analysis – Holmes Run

**Legend**

<b>Capacity</b>	<b>Flood Volume (cu. ft.)</b>
Sufficient Capacity	0.01 - 1,000
Surcharged	1,000 - 10,000
Insufficient Freeboard	10,000 - 200,000
Not Analyzed (Private, disconnected, upstream of runoff input)	

- Modeled Streams
  - City of Alexandria Streams
  - Water Bodies
  - Watershed
- Note: Subwatershed number provided in upper corner of each subwatershed

**FIGURE 5**

Holmes Run Watershed Modeling Results  
Stormwater Capacity Analysis for Holmes Run Watershed, City of Alexandria, Virginia

0 700 1,400 2,800  
Feet



CH2MHILL



## Summary

The hydraulic model predicts that about half of the Holmes Run watershed is experiencing capacity deficiencies during the 10-year, 24-hour design storm. The majority of the capacity deficiencies are seen in the lower half of Holmes Run. The model results show that 18 percent of the pipes flood the ground surface, 16 percent have a hydraulic grade line within 2 feet of the surface, and 19 percent surcharge above the crown of the pipe. Comparing the peak runoff to the estimated inlet capacity of each catchment indicates that 44 percent of the catchments in the model may have insufficient inlet capacity. Maps and profiles of flooding areas are presented in this technical memorandum to assist in locating problem areas and understanding the capacity deficiencies of the drainage system.

The hydraulic modeling results presented in this memorandum should be reviewed with the understanding that several assumptions were made to fill data gaps, primarily assumptions of inverts in pipes with diameters less than 24 inches.

## References

These documents were consulted in the preparation of this memorandum. Not all are cited in the text.

City of Alexandria. 1989. *Design and Construction Standards*. Department of Transportation & Environmental Services. July.

City of Alexandria. 2008. City of Alexandria GIS data. Spring.

City of Alexandria. 2011. City of Alexandria GIS data. Spring.

CH2M HILL. 2009a. *Updated Precipitation Frequency Results and Synthesis of New IDF Curves for the City of Alexandria, Virginia*. Prepared for City of Alexandria Transportation & Environmental Services Department. May 1.

CH2M HILL. 2009b. Comparison of Model Hyetograph Generation and Hydrologic Computation Methods. Prepared for City of Alexandria Transportation & Environmental Services Department. July 14.

CH2M HILL. 2009c. *Sea Level Rise Potential for the City of Alexandria, Virginia*. Prepared for City of Alexandria Transportation & Environmental Services Department. June 12.

CH2M HILL. 2011. *Rainfall Frequency and Global Change Model Options for the City of Alexandria*. Prepared for City of Alexandria Transportation & Environmental Services Department. August 30.

CH2M HILL. 2012a. *Inlet Capacity Analysis for City of Alexandria Storm Sewer Capacity Analysis*. Prepared for the City of Alexandria Transportation & Environmental Services Department. September 12.

CH2M HILL. 2012b. *Summary of Data Gaps and Assumptions in the Hooffs Run Watershed*, Prepared for the City of Alexandria Transportation & Environmental Services Department. October 22.

CH2M HILL. 2016. *Stormwater Capacity Analysis for Hooffs Run Watershed, City of Alexandria, Virginia*. Prepared for the City of Alexandria Transportation & Environmental Services Department. February.

U.S. Army Corps of Engineers (USACE). 2003. *User's Manual, Geospatial Hydrologic Modeling Extension HEC-GeoHMS*. Hydrologic Engineering Center, the US Army Corps of Engineers. Version 1.1. December.



**Attachment A**

**Methodology for Identifying Public vs. Private  
Structures: August 6, 2009, Meeting Summary**

---



# **City of Alexandria Storm Sewer Capacity Analysis Project – Task Order 1**

**Meeting, August 6, 2009 (2:30-3:00 pm)**

**ATTENDEES:**

Craig Perl/City of Alexandria  
Laurens van der Tak/CH2M HILL  
Cheri Salas/ CH2M HILL

FROM: Cheri Salas/CH2M HILL

DATE: August 7, 2009

PROJECT NUMBER: 383412

## **Meeting Purpose**

Review memorandum dated July 31, 2009, entitled Evaluation of modeling issues discussed during July 27, 2009 Progress Meeting

- Discuss results of initial public\private structure determinations
- Review initial evaluation of survey data quality
- Discuss altered approach to filling data gaps associated with missing inlet inverts

## **Meeting Review**

### **Private vs. Public Structures**

It was difficult to readily identify structures as private or public, based solely on the parcel layer because of potential errors in the structure locations. The memorandum includes several examples. Several of these include individual public structures that are upstream of larger private storm sewer areas. Craig will share these with Suzanne and others to confirm a path forward. It was agreed that regardless of the path forward on future sewersheds, we would not change the model for the pilot sewershed, but will not attempt to evaluate capacity limitations in the private areas. Craig will confirm which areas in the memo examples should be evaluated.

As we move into the remainder of Hooffs Run CH2M HILL will identify large areas of private sewers based on a broad visual review of the sewersheds, CH2M HILL will recommend a starting point for the hydraulic model (pour point for hydrologic basin) and allow the City to review the recommendations prior to beginning filling data gaps or modeling.

Stormwater ponds were discussed. These are mostly, if not all, private facilities; however they should have significant impact on the peak flows in the system. It was recognized that there is significant effort associated with obtaining the data for these ponds, and adding it to

the model. The one pond in the pilot sewershed was retrofitted since the as-built plans; therefore a site visit may be required to obtain appropriate outlet dimensions.

### **Survey Data Quality**

We do not foresee any significant data issues in the Pilot sewershed related to surveyed inverts; however it may be a bigger issue as we move into flatter sewersheds. This issue will be tabled until we move on to other sewersheds

### **Filling Data Gaps in Inlet Inverts**

As we were filling data gaps we recommended using a 1-foot depth to invert for all inlets for which the data were not available. In approximately 15 of the 153 inlets for which invert data were not available, the pipe diameter was larger than 12-inches, resulting in model errors. A revised approach of using the pipe diameter plus 6-inches as the assumed depth to invert is recommended, however it is unclear whether this approach will be appropriate for the locations in question. CH2M HILL will provide a Google Earth Map of these inlets and Craig will review, and possibly conduct field inspections. CH2M HILL will not continue modeling of the pilot shed until results of this review are received.

### **Action Items**

Craig will share July 31, 2009 memo with additional City staff and determine extent of capacity evaluation in pilot area. He will also confirm recommended path forward.

Craig will determine preferred approach to inclusion of stormwater ponds in the model.

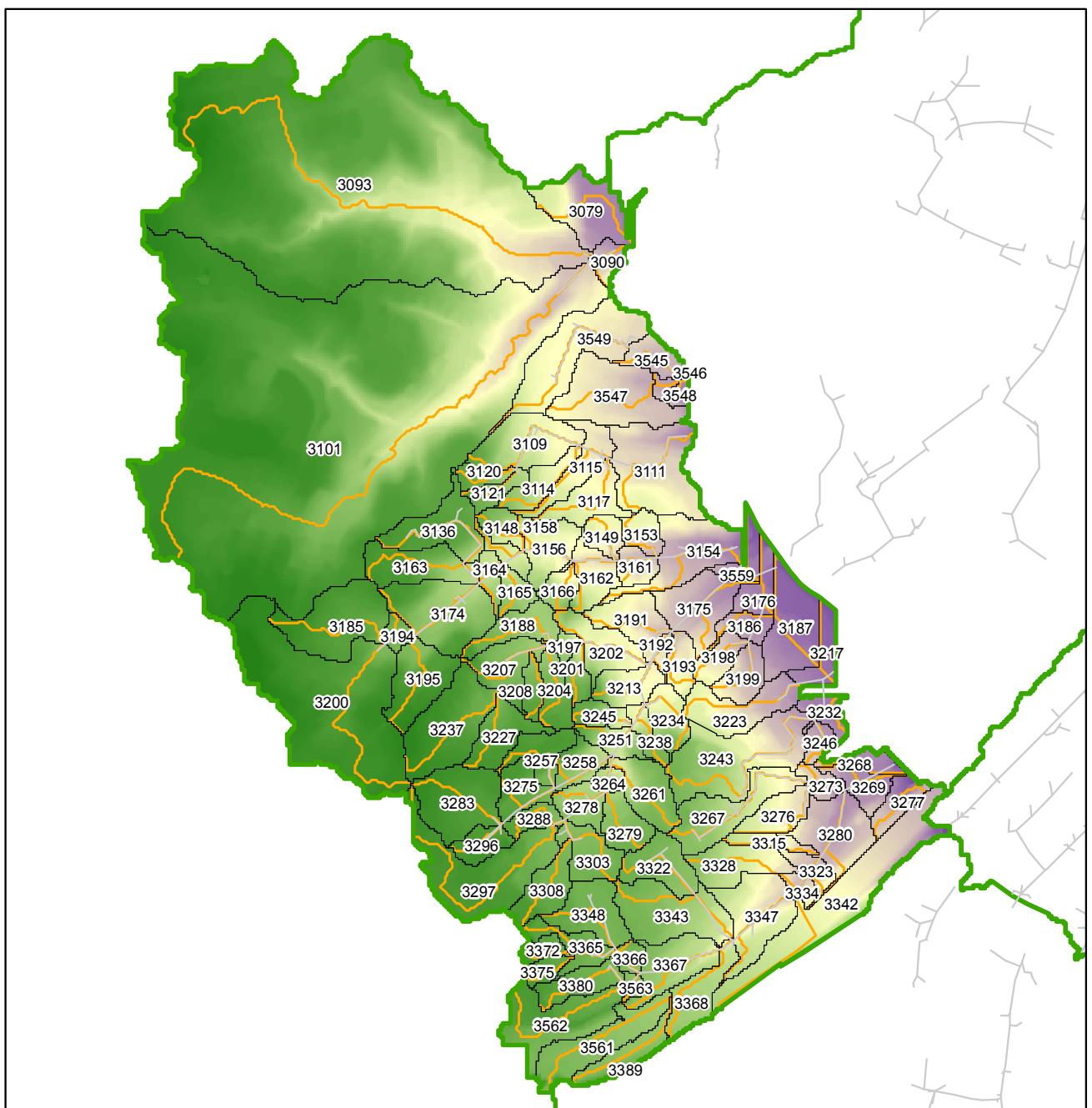
Cheri will provide Google Earth maps of locations where a 1-foot depth to invert was not sufficient.

Craig will review these sites and provide input on an appropriate assumption moving forward.

**Attachment B**  
**Hydrologic Model Schematic and Parameters**

---





## LEGEND

---

DGravityMain

## Subwatersheds

## Modeled Catchments

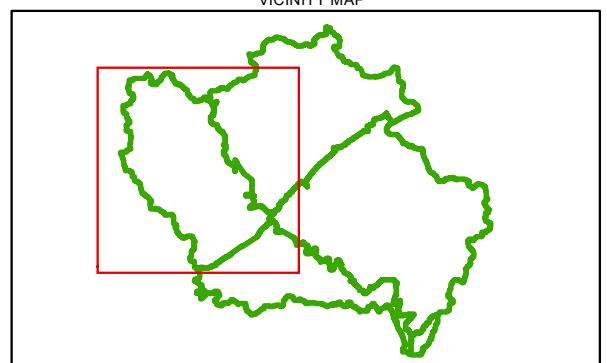
— Longest Flow Path

### **DEM Elevation (ft)**

High : 276

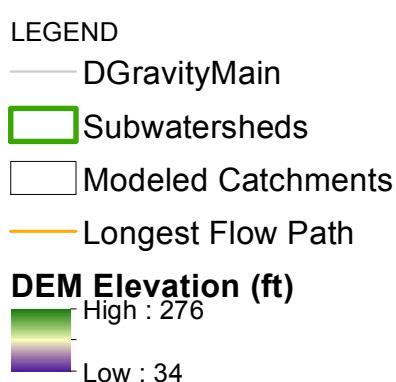
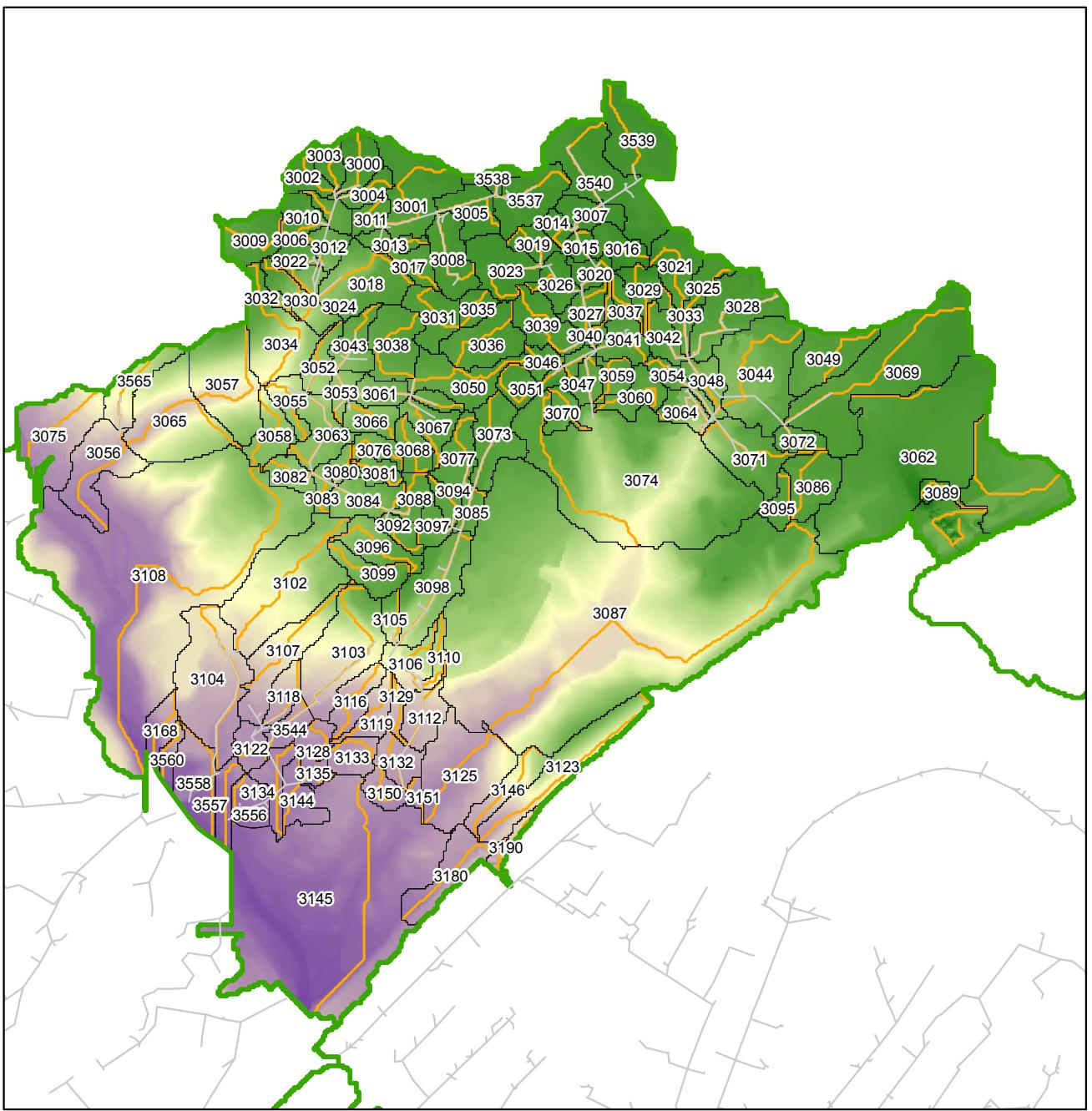
Low : 34

A horizontal number line representing distance in feet. The line starts at 0 and ends at 2,300. There are tick marks at 0, 1,150, and 2,300. The word "Feet" is written below the line.

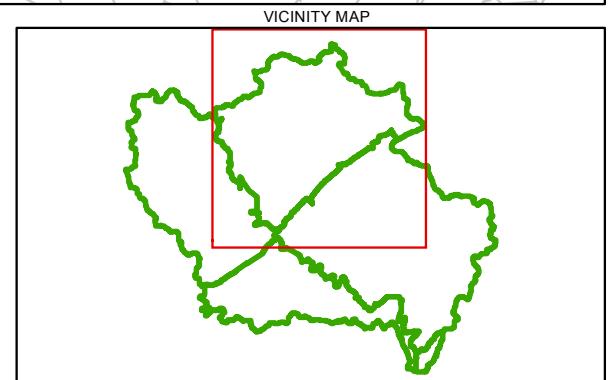


**FIGURE 1**  
**Holmes Run Subwatershed 1 Catchments**  
Stormwater Capacity Analysis for Holmes Run  
Watershed, City of Alexandria, Virginia  
*City of Alexandria Storm Sewer Capacity Analysis*



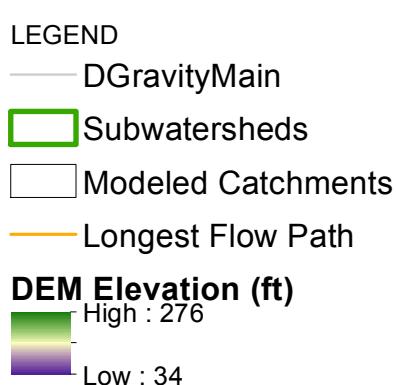
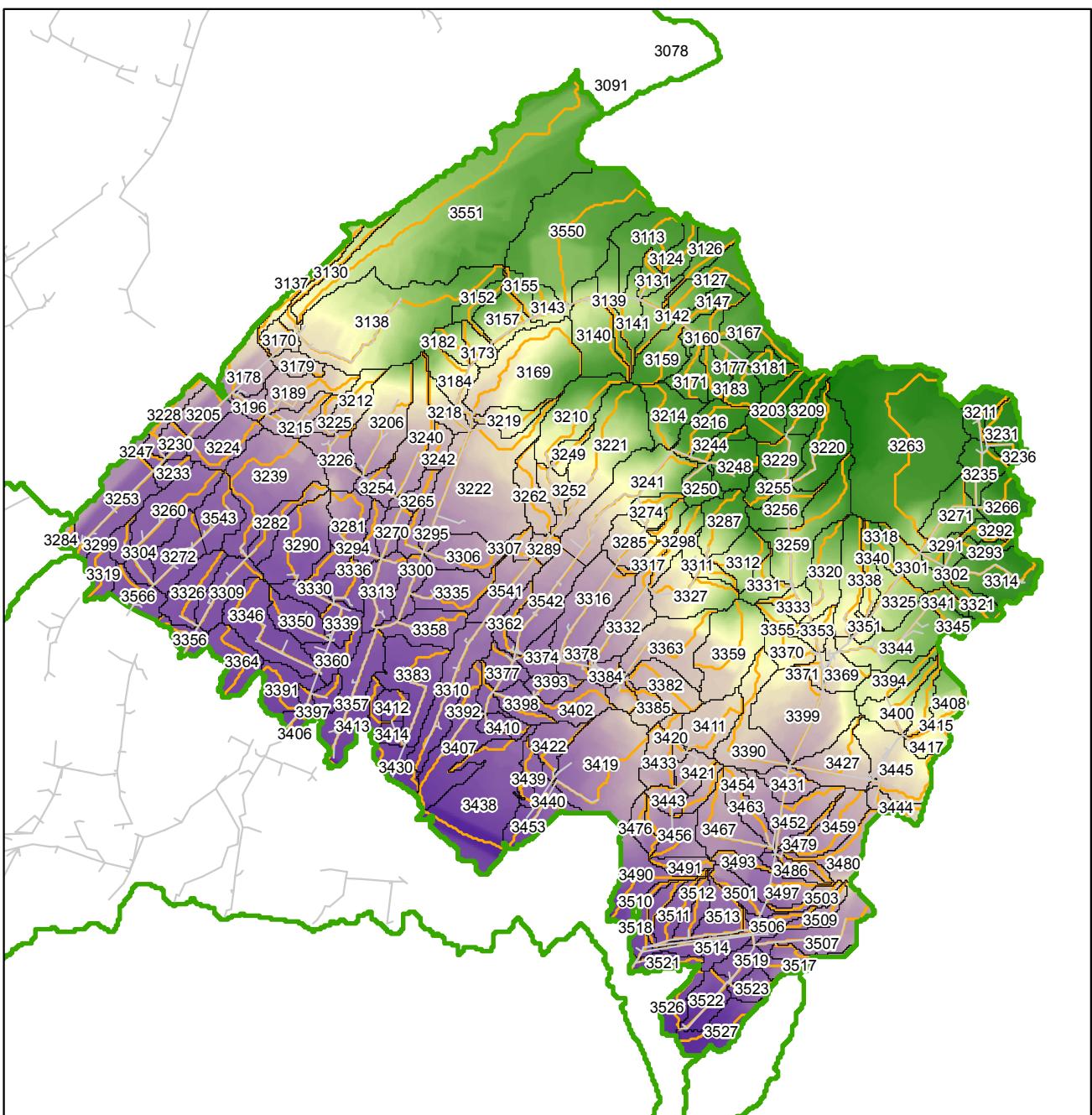


0      1,250      2,500  
Feet

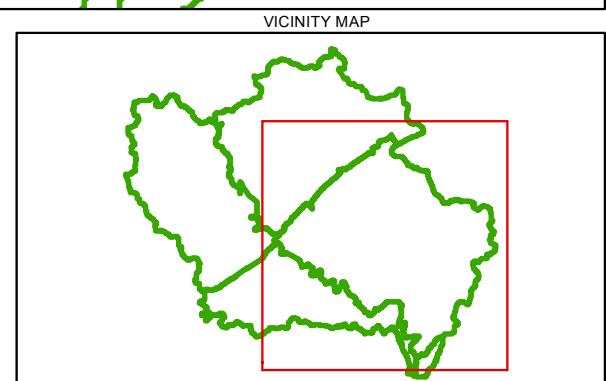


**FIGURE 2**  
**Holmes Run Subwatershed 2 Catchments**  
Stormwater Capacity Analysis for Holmes Run  
Watershed, City of Alexandria, Virginia  
City of Alexandria Storm Sewer Capacity Analysis



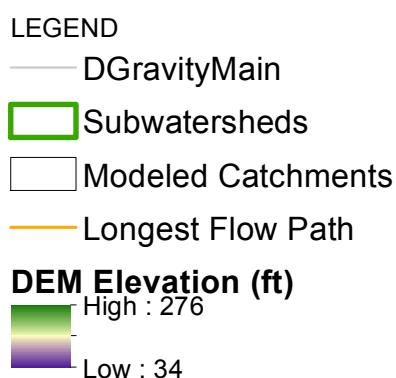
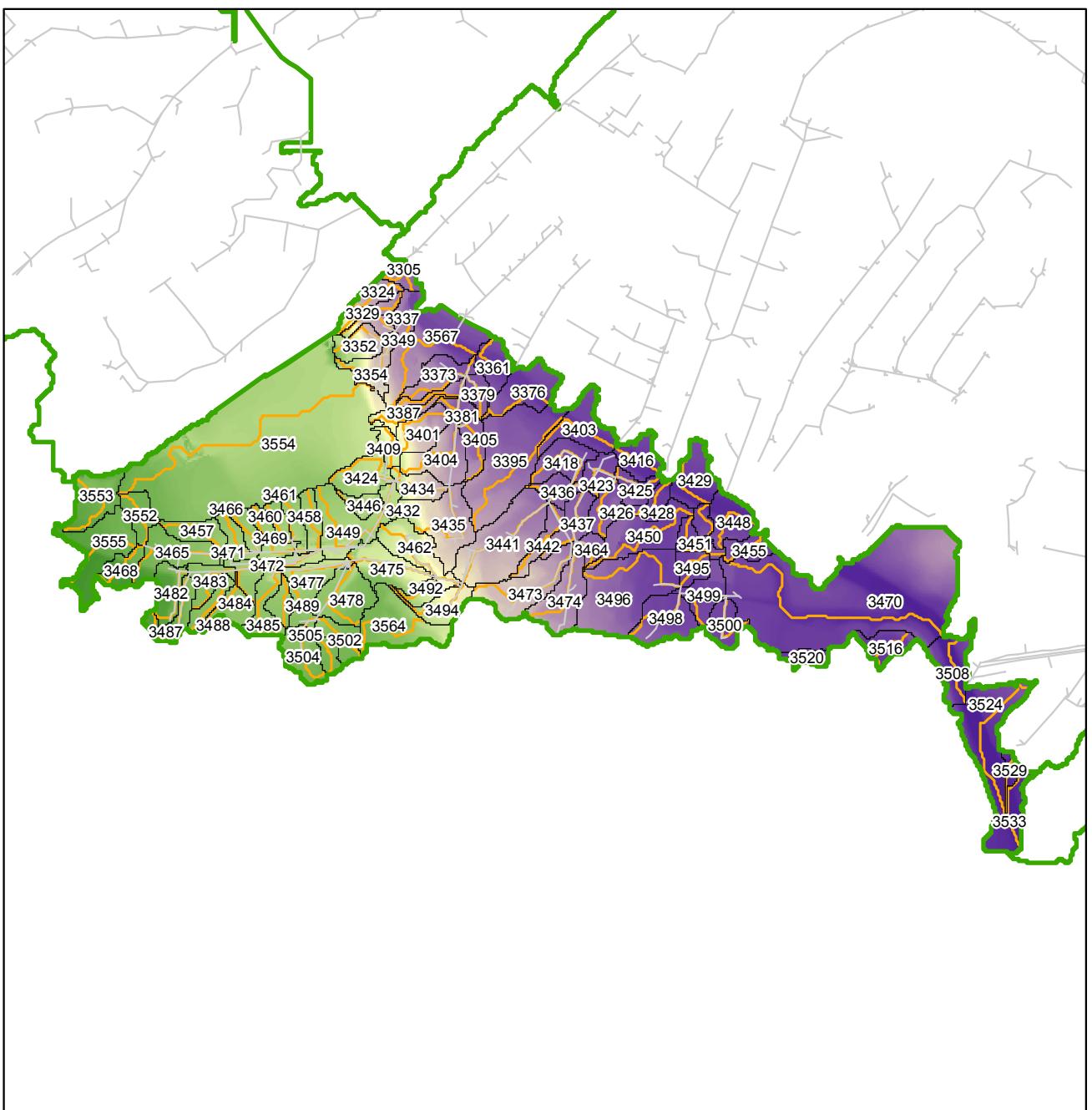


0                  1,400                  2,800  
Feet

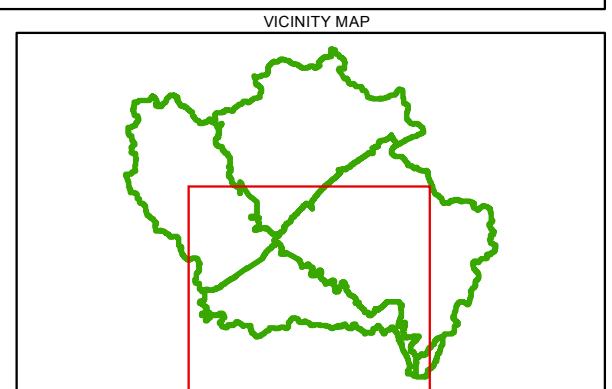


**FIGURE 3**  
**Holmes Run Subwatershed 3 Catchments**  
 Stormwater Capacity Analysis for Holmes Run  
 Watershed, City of Alexandria, Virginia  
*City of Alexandria Storm Sewer Capacity Analysis*





0      1,400      2,800  
Feet



**FIGURE 3**  
**Holmes Run Subwatershed 3 Catchments**  
Stormwater Capacity Analysis for Holmes Run  
Watershed, City of Alexandria, Virginia  
City of Alexandria Storm Sewer Capacity Analysis



TABLE 1

**Infiltration Data**

Parameter	Value
Average Capillary Suction (in)	8.27
Initial Moisture Deficit	0.154
Saturated Hydraulic Conductivity (in/hr)	0.2

TABLE 2

**Hydrologic Parameters for Holmes Run Catchments**

Subwatershed	HydroID	Area (ac)	Basin Slope (%)	Width	Percent Impervious	Model Load Point
1	3090	1.0	20.5	92	15	001525IN
1	3093	66.2	11.3	41	26	000503SMH
1	3101	92.4	10.9	30	26	001526IN
1	3109	4.2	13.2	183	31	000967SMH
1	3111	6.4	11.0	290	22	002822IN
1	3114	1.8	12.4	101	14	002760IN
1	3115	2.4	7.7	119	24	000969SMH
1	3117	2.5	7.8	138	39	002763IN
1	3120	0.9	11.6	88	22	002766IN
1	3121	1.1	11.2	104	56	000972SMH
1	3136	3.7	8.2	155	39	002823IN
1	3148	1.2	20.5	117	18	002800IN
1	3149	1.3	11.9	140	37	002806IN
1	3153	1.3	15.6	130	25	002825IN
1	3154	4.7	16.5	164	38	000904SMH
1	3156	2.7	15.1	217	22	002803IN
1	3158	0.9	14.0	84	32	002800IN
1	3161	1.2	20.5	144	38	002819IN
1	3162	2.2	18.2	151	40	000981SMH
1	3163	3.4	11.0	155	31	002949IN
1	3164	0.9	9.6	92	36	002786IN
1	3165	1.2	10.1	114	33	002791IN
1	3166	1.1	22.8	122	7	002817IN
1	3174	5.4	13.9	249	29	002779IN
1	3175	3.8	11.4	190	46	000905SMH
1	3176	1.6	11.9	193	43	002813IN
1	3185	5.4	6.5	244	33	000903SMH
1	3186	1.2	11.6	96	67	002813IN
1	3188	2.2	6.9	123	26	002792IN
1	3191	2.5	12.9	168	47	002915IN
1	3192	0.7	9.8	73	50	002916IN
1	3193	1.4	12.1	115	48	002921IN
1	3194	0.7	9.5	103	41	000903SMH
1	3195	3.7	10.7	202	29	002778IN

TABLE 2

**Hydrologic Parameters for Holmes Run Catchments**

<b>Subwatershed</b>	<b>HydroID</b>	<b>Area (ac)</b>	<b>Basin Slope (%)</b>	<b>Width</b>	<b>Percent Impervious</b>	<b>Model Load Point</b>
1	3197	0.6	17.2	92	21	002820IN
1	3198	1.4	13.9	140	72	002810IN
1	3199	1.9	14.4	158	65	002807IN
1	3200	16.8	5.5	65	23	000340ND
1	3201	1.0	18.0	100	13	002820IN
1	3202	2.8	16.5	144	41	002821IN
1	3204	1.9	8.9	126	45	002799IN
1	3207	2.7	10.1	157	31	002795IN
1	3208	1.0	8.4	83	23	002795IN
1	3213	2.0	18.5	162	47	001521SMH
1	3223	3.7	12.8	48	49	004671IN
1	3227	2.6	6.9	182	20	000339ND
1	3232	1.2	8.9	114	45	004667IN
1	3234	2.0	16.7	155	42	004674IN
1	3237	5.6	7.4	50	26	000339ND
1	3238	1.0	14.1	89	37	004676IN
1	3243	7.4	13.8	172	55	004741IN
1	3245	1.2	24.1	114	12	004677IN
1	3246	0.9	13.3	98	26	004750IN
1	3251	1.5	23.6	134	24	001520SMH
1	3257	2.1	7.2	143	33	004680IN
1	3258	1.7	20.6	135	38	004678IN
1	3261	2.9	13.5	173	58	004784IN
1	3264	0.6	11.3	120	50	004785IN
1	3267	4.3	10.0	151	55	004731IN
1	3268	1.0	9.5	70	56	004672IN
1	3269	1.7	9.9	115	60	004672IN
1	3273	1.0	15.6	109	63	001517SMH
1	3275	2.0	9.1	170	41	004775IN
1	3276	2.0	12.0	121	54	004743IN
1	3278	1.7	11.4	178	70	001528SMH
1	3279	2.0	8.2	180	53	004781IN
1	3280	4.0	14.6	220	44	004753IN
1	3283	4.7	4.1	100	19	004766IN
1	3288	1.1	7.0	83	87	001525SMH
1	3296	1.4	5.8	150	55	004766IN
1	3297	7.2	5.0	161	59	001525SMH
1	3303	2.4	4.1	156	59	004778IN
1	3308	2.4	6.3	144	73	004778IN
1	3315	1.0	11.6	63	52	004753IN
1	3322	2.8	4.3	172	65	004720IN
1	3323	1.0	15.5	106	27	004754IN
1	3328	3.0	11.7	69	59	004755IN

TABLE 2

**Hydrologic Parameters for Holmes Run Catchments**

<b>Subwatershed</b>	<b>HydroID</b>	<b>Area (ac)</b>	<b>Basin Slope (%)</b>	<b>Width</b>	<b>Percent Impervious</b>	<b>Model Load Point</b>
1	3334	0.7	19.4	147	14	004755IN
1	3343	5.1	8.7	70	51	004726IN
1	3347	4.5	15.2	229	28	004757IN
1	3348	3.2	3.9	203	76	004711IN
1	3365	1.9	6.3	117	60	004705IN
1	3366	0.7	5.6	98	68	004719IN
1	3367	3.3	12.5	174	44	004710IN
1	3372	0.8	6.9	76	68	004705IN
1	3375	0.8	5.9	94	86	004705IN
1	3380	2.0	6.0	119	64	001509SMH
1	3545	1.6	8.7	131	39	001534IN
1	3549	6.4	5.3	177	36	000504SMH
1	3559	1.3	10.9	245	37	002912IN
1	3562	5.0	12.7	83	39	001511SMH
1	3563	0.4	9.7	86	37	004707IN
2	3000	2.0	3.0	147	21	001546IN
2	3001	5.0	2.4	127	33	000526SMH
2	3002	1.5	2.0	129	15	001544IN
2	3003	1.0	3.9	116	29	001545IN
2	3004	1.1	3.1	102	55	001551IN
2	3005	2.3	1.5	167	33	000522SMH
2	3006	1.0	5.9	126	29	001553IN
2	3007	1.7	2.1	259	49	001624IN
2	3008	3.0	2.6	187	44	000524SMH
2	3010	1.6	5.5	157	34	001555IN
2	3011	1.1	2.9	150	37	001585IN
2	3012	1.4	8.7	140	23	000513SMH
2	3013	1.1	6.8	108	23	000113IO
2	3014	0.8	0.5	115	42	001623IN
2	3015	0.8	3.1	125	76	000546SMH
2	3016	1.7	5.9	6613	53	000547SMH
2	3017	1.3	3.5	106	4	000113IO
2	3018	4.8	11.3	236	6	000117IO
2	3019	1.3	1.5	123	43	001596IN
2	3020	1.1	6.0	132	58	001620IN
2	3021	2.7	4.5	160	54	000136IO
2	3022	1.0	8.6	110	35	000512SMH
2	3023	3.3	1.5	204	40	001593IN
2	3024	0.8	11.9	96	53	001535IN
2	3025	1.3	2.3	114	66	000136IO
2	3026	1.8	3.0	147	50	000574SMH
2	3027	1.5	7.3	132	35	000002PD
2	3028	4.7	4.6	210	51	002029IN

TABLE 2

**Hydrologic Parameters for Holmes Run Catchments**

<b>Subwatershed</b>	<b>HydroID</b>	<b>Area (ac)</b>	<b>Basin Slope (%)</b>	<b>Width</b>	<b>Percent Impervious</b>	<b>Model Load Point</b>
2	3029	1.6	6.0	117	62	000644SMH
2	3031	2.5	2.2	202	38	001963IN
2	3033	1.2	5.0	88	52	000643SMH
2	3035	1.1	3.3	146	22	001963IN
2	3036	3.6	2.2	222	60	001963IN
2	3037	0.8	4.6	67	56	000644SMH
2	3038	3.5	4.3	183	72	001963IN
2	3039	2.9	3.6	144	55	000646SMH
2	3040	0.8	4.0	54	48	000645SMH
2	3041	1.9	4.4	185	54	000644SMH
2	3042	1.6	4.5	110	59	001991IN
2	3043	2.1	7.9	149	54	001979IN
2	3044	7.6	8.2	316	59	000003PD
2	3045	0.6	3.8	90	68	000648SMH
2	3046	0.9	5.7	109	74	001924IN
2	3047	1.2	5.4	133	47	002031IN
2	3048	1.6	6.4	115	21	000003PD
2	3049	3.7	2.7	254	62	000003PD
2	3050	3.6	3.7	152	57	001963IN
2	3051	1.8	6.9	95	37	001922IN
2	3052	1.5	9.4	108	55	001983IN
2	3053	1.0	7.2	102	65	001975IN
2	3054	1.2	9.0	84	47	001993IN
2	3055	1.6	20.1	115	30	000663SMH
2	3059	1.2	4.5	110	97	004053SMH
2	3061	2.2	6.3	114	68	001962IN
2	3063	2.9	7.4	143	62	000654SMH
2	3064	1.6	17.7	105	54	000664SMH
2	3066	1.6	9.0	147	54	001960IN
2	3067	1.9	7.8	137	63	001964IN
2	3068	1.5	5.0	126	70	001964IN
2	3069	12.5	1.9	343	58	000254ND
2	3071	4.2	10.7	201	46	001996IN
2	3072	1.1	1.7	135	68	002020IN
2	3073	3.4	4.3	191	52	000649SMH
2	3076	1.2	6.8	90	59	001951IN
2	3077	2.3	2.1	153	74	001933IN
2	3080	0.8	8.6	105	50	001951IN
2	3081	1.1	8.1	97	49	001951IN
2	3082	1.4	7.0	131	58	001953IN
2	3083	0.8	8.6	92	56	001952IN
2	3084	2.5	8.7	164	55	001948IN
2	3085	1.0	7.4	103	54	001940IN

TABLE 2

**Hydrologic Parameters for Holmes Run Catchments**

<b>Subwatershed</b>	<b>HydroID</b>	<b>Area (ac)</b>	<b>Basin Slope (%)</b>	<b>Width</b>	<b>Percent Impervious</b>	<b>Model Load Point</b>
2	3088	1.3	3.6	107	84	000652SMH
2	3092	1.1	7.4	107	60	001947IN
2	3094	0.9	2.4	88	90	001936IN
2	3096	2.5	9.2	124	58	000338ND
2	3097	1.1	6.3	148	67	002019IN
2	3098	4.9	14.9	210	44	002010IN
2	3099	2.2	8.6	134	69	000338ND
2	3102	9.6	10.8	313	38	000338ND
2	3103	6.8	14.8	283	42	003011IN
2	3104	8.3	7.4	262	46	000915SMH
2	3105	0.9	21.1	100	21	002013IN
2	3106	2.1	17.4	141	53	002957IN
2	3107	4.4	9.6	169	36	000913SMH
2	3110	0.9	12.3	59	55	002960IN
2	3112	2.3	7.7	147	58	002961IN
2	3116	2.0	11.4	116	40	000363ND
2	3118	1.5	9.4	114	48	000911SMH
2	3119	1.7	8.1	101	54	000363ND
2	3122	1.5	3.5	160	50	002945IN
2	3128	1.0	7.6	115	55	000363ND
2	3129	0.8	7.0	66	42	002962IN
2	3132	1.8	5.1	163	55	002962IN
2	3133	1.7	6.0	148	48	000363ND
2	3134	1.8	5.5	115	55	002952IN
2	3135	0.9	6.7	137	65	001010SMH
2	3144	1.9	5.1	137	55	000921SMH
2	3150	1.3	5.8	120	60	000362ND
2	3151	0.5	8.1	61	50	002963IN
2	3537	3.6	1.7	246	34	001561IN
2	3538	0.8	1.6	94	33	001568IN
2	3539	4.8	1.6	284	23	001631IN
2	3540	6.8	2.2	253	35	001631IN
2	3544	1.3	6.9	624	49	002930IN
2	3556	1.8	6.5	4444	63	002952IN
2	3565	2.4	12.9	127	34	000502SMH
3	3113	4.1	5.6	263	52	000323IO
3	3124	1.7	7.1	127	82	000323IO
3	3126	1.9	5.3	4129	72	001458SMH
3	3127	3.4	6.8	161	49	001456SMH
3	3130	1.7	4.9	55	54	002981IN
3	3131	1.2	12.9	100	35	000323IO
3	3137	1.6	7.8	47	52	003020IN
3	3138	16.3	10.5	312	47	001004SMH

TABLE 2

**Hydrologic Parameters for Holmes Run Catchments**

<b>Subwatershed</b>	<b>HydroID</b>	<b>Area (ac)</b>	<b>Basin Slope (%)</b>	<b>Width</b>	<b>Percent Impervious</b>	<b>Model Load Point</b>
3	3139	2.2	13.8	122	31	001459SMH
3	3140	4.8	14.9	218	18	001461SMH
3	3141	2.0	14.2	139	19	001459SMH
3	3142	1.9	11.4	117	44	001458SMH
3	3143	1.5	15.6	134	22	001479SMH
3	3147	1.3	6.3	101	19	004549IN
3	3152	1.4	8.3	77	39	001009SMH
3	3155	1.0	17.1	89	5	004567IN
3	3157	2.8	21.4	182	20	001480SMH
3	3159	3.0	9.8	193	26	000571ND
3	3160	1.5	9.7	118	40	001454SMH
3	3167	3.4	7.2	179	37	004539IN
3	3169	9.3	16.2	263	10	002999IN
3	3170	1.2	9.8	140	46	003022IN
3	3171	1.8	6.8	141	34	004535IN
3	3172	1.3	10.0	110	41	004536IN
3	3173	1.3	16.3	135	20	001008SMH
3	3177	1.3	9.0	119	19	004534IN
3	3178	3.1	9.7	152	55	003019IN
3	3179	1.3	6.5	117	61	000998SMH
3	3181	1.6	4.9	114	43	004574IN
3	3182	1.3	22.2	137	15	003002IN
3	3183	1.6	4.0	118	39	004584IN
3	3184	2.7	16.0	122	27	001005SMH
3	3189	3.4	6.6	149	52	002967IN
3	3196	1.0	3.7	114	67	000994SMH
3	3203	3.2	5.0	2982	47	002688IN
3	3205	2.5	11.2	189	56	003368IN
3	3206	5.9	12.7	239	28	003147IN
3	3209	2.2	8.6	147	31	002691IN
3	3210	4.7	15.6	197	22	002647IN
3	3211	1.9	2.9	153	73	002565IN
3	3212	2.1	11.2	140	56	003158IN
3	3214	3.3	15.0	202	24	002752IN
3	3215	2.0	4.3	131	67	003161IN
3	3216	2.9	7.9	145	34	004587IN
3	3218	1.5	9.8	83	29	001039SMH
3	3219	1.7	13.7	103	35	000954SMH
3	3220	4.4	8.5	195	30	000965SMH
3	3221	8.5	13.9	258	21	000945SMH
3	3222	13.3	6.2	278	21	003171IN
3	3224	3.3	4.5	174	61	000399ND
3	3225	0.8	7.9	87	27	003159IN

TABLE 2

**Hydrologic Parameters for Holmes Run Catchments**

<b>Subwatershed</b>	<b>HydroID</b>	<b>Area (ac)</b>	<b>Basin Slope (%)</b>	<b>Width</b>	<b>Percent Impervious</b>	<b>Model Load Point</b>
3	3226	2.9	6.7	196	50	003152IN
3	3228	1.7	6.3	81	51	003365IN
3	3229	2.4	17.9	167	27	002681IN
3	3230	1.0	9.3	110	53	003367IN
3	3231	1.4	3.8	138	77	002566IN
3	3233	1.0	2.2	5640	54	003371IN
3	3235	2.5	9.3	153	35	002562IN
3	3236	1.0	3.8	114	6	000878SMH
3	3239	8.9	5.6	267	57	001068SMH
3	3240	4.4	10.0	152	15	003181IN
3	3241	7.7	14.5	373	18	000943SMH
3	3242	1.2	5.7	138	34	003138IN
3	3244	1.1	8.2	80	8	002751IN
3	3247	0.7	5.7	68	62	001096SMH
3	3248	2.7	6.4	224	31	002687IN
3	3249	1.0	9.1	95	40	000953SMH
3	3250	1.5	9.8	112	34	000959SMH
3	3252	1.5	7.7	134	40	000944SMH
3	3253	5.9	8.8	241	49	003373IN
3	3254	1.4	3.5	115	42	003167IN
3	3255	1.1	15.9	119	30	002679IN
3	3256	2.7	19.7	200	31	000957SMH
3	3259	6.1	18.1	196	16	002672IN
3	3260	5.2	1.7	221	54	003307IN
3	3262	2.6	4.2	122	49	000946SMH
3	3263	23.3	6.3	392	56	009929IN
3	3265	1.1	3.6	101	47	003169IN
3	3266	2.9	8.9	270	45	002559IN
3	3270	1.5	3.4	123	24	001049SMH
3	3271	3.0	17.5	193	15	000890SMH
3	3272	3.4	1.2	416	58	001074SMH
3	3274	1.6	17.5	120	29	002657IN
3	3281	3.0	8.0	151	23	003229IN
3	3282	2.1	6.8	99	57	003282IN
3	3285	2.6	9.9	175	26	002677IN
3	3286	0.9	19.7	90	16	000955SMH
3	3287	3.2	18.5	215	19	002694IN
3	3289	0.9	3.7	116	54	000947SMH
3	3290	5.4	6.9	129	35	003257IN
3	3291	0.8	7.0	113	60	002729IN
3	3292	0.9	13.6	76	37	002730IN
3	3293	1.1	10.3	87	28	002731IN
3	3294	1.3	4.6	102	46	003221IN

TABLE 2

**Hydrologic Parameters for Holmes Run Catchments**

<b>Subwatershed</b>	<b>HydroID</b>	<b>Area (ac)</b>	<b>Basin Slope (%)</b>	<b>Width</b>	<b>Percent Impervious</b>	<b>Model Load Point</b>
3	3295	1.0	4.6	80	49	003205IN
3	3298	1.7	18.5	93	16	002572IN
3	3299	1.0	0.4	120	51	003310IN
3	3300	1.9	4.2	132	22	003185IN
3	3301	2.2	18.2	165	9	002727IN
3	3302	0.5	17.1	95	21	002746IN
3	3304	1.0	1.7	125	49	003304IN
3	3306	3.1	6.1	182	35	003182IN
3	3307	0.9	4.7	94	35	000948SMH
3	3309	2.9	1.3	151	48	001065SMH
3	3310	5.5	3.8	269	45	001044SMH
3	3311	1.6	10.2	125	37	002654IN
3	3312	2.5	18.1	168	28	002660IN
3	3313	3.2	4.8	168	38	003202IN
3	3314	4.6	7.7	222	31	002842IN
3	3316	5.9	5.1	248	31	000927SMH
3	3317	0.8	10.4	69	31	000927SMH
3	3318	1.2	18.8	98	4	002727IN
3	3320	3.5	12.2	149	39	002702IN
3	3321	1.5	7.8	99	33	002732IN
3	3325	2.7	11.0	182	29	002726IN
3	3326	3.0	1.7	170	23	001063SMH
3	3327	4.4	13.2	217	22	002602IN
3	3330	2.5	3.1	154	30	001061SMH
3	3331	1.6	13.4	126	29	002668IN
3	3332	4.2	7.1	187	39	000925SMH
3	3333	1.3	11.8	109	27	002693IN
3	3335	3.6	5.2	153	32	003189IN
3	3336	1.9	6.3	170	40	003234IN
3	3338	3.5	12.9	146	25	002721IN
3	3339	1.6	2.4	135	44	001052SMH
3	3340	1.4	11.5	79	47	002724IN
3	3341	0.8	10.7	79	45	002733IN
3	3344	5.0	10.4	223	57	002739IN
3	3345	1.1	18.1	97	49	002734IN
3	3346	5.4	1.2	192	38	001094SMH
3	3350	2.6	1.3	164	38	001092SMH
3	3351	0.7	18.8	94	46	002723IN
3	3353	1.2	7.7	116	40	000334ND
3	3355	1.0	11.8	89	10	000334ND
3	3356	1.3	2.9	103	46	001063SMH
3	3357	5.7	3.0	192	37	003214IN
3	3358	3.2	3.8	166	38	001045SMH

TABLE 2

**Hydrologic Parameters for Holmes Run Catchments**

<b>Subwatershed</b>	<b>HydroID</b>	<b>Area (ac)</b>	<b>Basin Slope (%)</b>	<b>Width</b>	<b>Percent Impervious</b>	<b>Model Load Point</b>
3	3359	6.3	13.0	281	19	000874SMH
3	3360	2.0	2.1	137	32	001055SMH
3	3362	1.2	4.6	78	17	000936SMH
3	3363	5.1	8.3	203	20	000873SMH
3	3369	2.1	11.2	165	32	000988SMH
3	3370	1.9	5.6	85	43	000334ND
3	3371	0.8	4.9	82	71	000768SMH
3	3374	1.7	3.3	155	41	000930SMH
3	3377	1.8	4.0	149	43	000754SMH
3	3378	0.9	4.4	111	50	000931SMH
3	3382	2.9	2.8	150	23	000761SMH
3	3383	5.6	4.1	213	24	003900IN
3	3384	1.0	6.6	120	49	000922SMH
3	3385	1.6	5.1	132	46	000761SMH
3	3386	0.9	10.9	102	46	002236IN
3	3390	5.0	5.3	150	59	002243IN
3	3391	2.8	2.3	211	27	001216SMH
3	3392	0.9	4.1	79	39	000753SMH
3	3393	1.4	4.1	143	30	000751SMH
3	3394	2.4	9.8	67	48	002260IN
3	3396	0.6	1.0	100	45	001216SMH
3	3397	1.0	3.4	129	15	000379ND
3	3398	1.8	3.0	125	19	000755SMH
3	3399	8.7	8.6	402	42	000766SMH
3	3400	2.7	11.9	145	48	002261IN
3	3402	2.7	7.0	149	36	000751SMH
3	3407	6.0	4.4	178	14	003813IN
3	3408	2.0	13.4	121	54	002263IN
3	3410	1.2	4.1	111	34	003844IN
3	3411	3.4	4.1	193	62	002239IN
3	3412	1.1	3.3	159	30	003898IN
3	3413	0.9	3.1	71	25	003898IN
3	3414	0.8	2.2	94	35	003898IN
3	3415	1.5	14.4	81	36	002263IN
3	3417	1.4	10.0	144	50	002264IN
3	3419	10.0	7.3	388	30	002212IN
3	3420	0.9	2.4	91	46	002237IN
3	3421	1.6	6.5	150	23	000760SMH
3	3422	2.3	4.6	131	30	002222IN
3	3427	3.9	7.3	179	51	002279IN
3	3430	1.8	2.8	128	16	003902IN
3	3431	1.9	4.4	170	54	000281ND
3	3433	2.2	6.6	77	42	002223IN

TABLE 2

**Hydrologic Parameters for Holmes Run Catchments**

<b>Subwatershed</b>	<b>HydroID</b>	<b>Area (ac)</b>	<b>Basin Slope (%)</b>	<b>Width</b>	<b>Percent Impervious</b>	<b>Model Load Point</b>
3	3439	1.4	3.1	88	29	002209IN
3	3440	1.1	4.0	84	26	002032IN
3	3443	1.2	8.1	136	23	002253IN
3	3444	1.3	4.5	107	61	000282ND
3	3445	5.3	8.6	266	48	000283ND
3	3452	4.1	4.9	144	50	000764SMH
3	3453	2.0	7.9	132	11	002032IN
3	3454	1.1	5.8	72	41	002252IN
3	3456	2.9	8.5	156	35	002252IN
3	3459	3.1	4.6	142	45	002272IN
3	3463	2.3	5.1	121	39	002275IN
3	3467	4.0	4.5	170	57	002246IN
3	3479	0.8	4.9	52	30	002273IN
3	3480	2.5	7.0	103	45	002272IN
3	3481	0.6	9.2	45	30	002272IN
3	3486	1.1	7.1	88	33	000769SMH
3	3493	0.9	5.0	69	52	000769SMH
3	3497	2.7	7.0	174	41	000769SMH
3	3501	1.7	7.7	123	64	000286ND
3	3503	1.0	10.4	63	25	000286ND
3	3506	1.4	4.0	93	65	000775SMH
3	3507	4.1	5.8	134	57	000786SMH
3	3509	1.3	8.0	78	49	000786SMH
3	3510	1.0	4.5	63	96	000681SMH
3	3511	2.0	4.7	106	92	002297IN
3	3512	1.4	3.9	87	88	002296IN
3	3513	2.4	3.8	126	89	002290IN
3	3514	1.5	1.1	91	82	000288ND
3	3515	0.8	2.6	78	83	000779SMH
3	3517	1.1	7.0	66	29	000786SMH
3	3518	1.5	3.7	82	82	000681SMH
3	3519	2.2	4.5	141	81	000716SMH
3	3521	1.3	6.1	84	75	000747SMH
3	3522	2.4	8.6	159	65	002124IN
3	3523	1.4	7.8	131	62	002110IN
3	3541	3.2	5.8	511	46	000949SMH
3	3542	4.8	5.9	581	36	000938SMH
3	3543	3.0	2.8	434	62	001071SMH
3	3550	14.6	6.3	60	41	000316IO
3	3551	31.3	8.0	16	49	002981IN
3	3566	2.1	1.9	203	58	003321IN
4	3349	0.8	16.2	70	45	001085SMH
4	3352	1.9	25.7	128	44	001080SMH

TABLE 2

**Hydrologic Parameters for Holmes Run Catchments**

<b>Subwatershed</b>	<b>HydroID</b>	<b>Area (ac)</b>	<b>Basin Slope (%)</b>	<b>Width</b>	<b>Percent Impervious</b>	<b>Model Load Point</b>
4	3354	1.7	19.8	111	41	001081SMH
4	3373	2.2	10.6	113	58	001087SMH
4	3379	1.0	4.4	107	67	003342IN
4	3381	0.9	15.4	51	28	001089SMH
4	3387	1.2	17.0	63	18	001089SMH
4	3388	0.6	11.9	84	30	001089SMH
4	3401	2.3	18.0	145	54	003911IN
4	3404	3.3	16.0	182	64	001234SMH
4	3405	1.6	7.8	114	65	003909IN
4	3409	0.9	18.9	104	37	001272SMH
4	3418	2.5	5.6	134	63	003826IN
4	3423	1.3	4.4	123	49	003827IN
4	3424	2.4	11.5	135	79	001272SMH
4	3425	1.4	8.2	124	60	003857IN
4	3426	1.8	6.2	144	50	000484ND
4	3432	0.8	10.0	90	64	003840IN
4	3434	1.6	18.5	135	54	001230SMH
4	3435	4.5	14.9	221	63	003831IN
4	3436	1.3	6.5	108	70	001259SMH
4	3437	2.0	6.2	115	65	003822IN
4	3441	6.6	8.9	263	56	003854IN
4	3442	1.5	9.0	77	66	001255SMH
4	3446	0.9	11.6	89	76	003842IN
4	3449	3.9	6.4	159	85	004284IN
4	3457	1.6	4.4	114	84	004253IN
4	3458	1.3	8.7	101	80	001341SMH
4	3460	1.1	10.1	100	76	000553ND
4	3461	0.9	3.9	110	88	000552ND
4	3462	3.1	14.2	155	33	003924IN
4	3464	0.8	5.8	111	42	003818IN
4	3465	3.2	6.6	159	67	004255IN
4	3466	1.1	3.8	108	85	000551ND
4	3468	1.5	8.3	113	69	000280IO
4	3469	1.4	10.4	101	78	004251IN
4	3471	1.4	4.8	112	90	004251IN
4	3472	2.1	9.4	94	77	004249IN
4	3473	4.2	7.7	177	56	003852IN
4	3474	3.3	8.0	169	70	003880IN
4	3475	3.1	20.7	169	51	003919IN
4	3477	2.3	11.2	122	33	004242IN
4	3478	3.4	8.7	214	66	004281IN
4	3482	1.8	14.6	131	63	004231IN
4	3483	1.4	4.1	108	92	001325SMH

TABLE 2

**Hydrologic Parameters for Holmes Run Catchments**

<b>Subwatershed</b>	<b>HydroID</b>	<b>Area (ac)</b>	<b>Basin Slope (%)</b>	<b>Width</b>	<b>Percent Impervious</b>	<b>Model Load Point</b>
4	3484	1.6	1.9	119	97	001371SMH
4	3485	2.0	4.8	109	84	004239IN
4	3487	1.8	6.6	93	85	001379SMH
4	3488	1.2	3.2	91	92	004236IN
4	3489	1.1	4.3	104	87	004240IN
4	3492	0.9	16.4	93	42	003918IN
4	3494	1.9	11.7	101	49	003917IN
4	3495	1.3	5.1	140	26	003937IN
4	3496	7.9	6.8	327	69	003937IN
4	3498	3.2	5.5	211	78	003935IN
4	3499	2.1	2.7	175	65	003875IN
4	3500	1.7	1.3	132	87	003939IN
4	3502	1.7	4.2	156	59	001360SMH
4	3504	2.3	4.1	178	68	001358SMH
4	3505	1.4	3.6	64	54	004280IN
4	3552	1.6	2.3	135	84	000280IO
4	3554	33.4	5.3	555	91	003331IN
4	3555	4.3	6.5	84	48	000280IO
4	3564	4.3	9.6	225	59	003917IN

Note: HydroID is a unique identifier created by ArcHydro

**Attachment C**  
**Detailed Inlet Capacity Results**

---



TABLE 1  
Detailed Inlet Capacity Results for Holmes Run

Sub-shed	Model Load Point	Total Drainage Area (ac)	Total Throat Count	Total Inlet Capacity (cfs)	Peak Runoff (cfs)	Inlet Capacity
1	000339ND	8.187	0	0.0	19.8	Insufficient
1	000340ND	16.834	1	3.3	23.7	Insufficient
1	000503SMH	66.224	0	0.0	59.9	Insufficient
1	000504SMH	6.384	8	26.0	20.0	
1	000903SMH	6.074	4	13.0	22.4	Insufficient
1	000904SMH	4.654	5	16.3	18.5	Insufficient
1	000905SMH	3.776	0	0.0	17.0	Insufficient
1	000967SMH	4.184	2	6.5	15.8	Insufficient
1	000969SMH	2.35	2	6.5	7.6	Insufficient
1	000972SMH	1.085	1	3.3	5.8	Insufficient
1	000981SMH	2.195	2	6.5	10.5	Insufficient
1	001509SMH	2.02	6	19.5	10.3	
1	001511SMH	4.959	4	13.0	16.1	Insufficient
1	001517SMH	0.95	1	3.3	5.3	Insufficient
1	001520SMH	1.462	0	0.0	6.9	Insufficient
1	001521SMH	2.03	2	6.5	10.4	Insufficient
1	001525IN	0.992	3	9.8	4.3	
1	001525SMH	8.301	14	45.5	36.4	
1	001526IN	92.366	2	6.5	57.2	Insufficient
1	001528SMH	1.699	1	3.3	9.6	Insufficient
1	001534IN	1.56	1	3.3	7.2	Insufficient
1	002760IN	1.777	1	3.3	5.7	Insufficient
1	002763IN	2.536	2	6.5	10.3	Insufficient
1	002766IN	0.888	1	3.3	3.8	Insufficient
1	002778IN	3.667	0	0.0	14.0	Insufficient
1	002779IN	5.429	9	29.3	20.2	
1	002786IN	0.94	4	13.0	4.4	
1	002791IN	1.162	2	6.5	5.3	
1	002792IN	2.247	2	6.5	7.5	Insufficient
1	002795IN	3.683	3	9.8	14.5	Insufficient
1	002799IN	1.865	2	6.5	8.6	Insufficient
1	002800IN	2.097	1	3.3	9.7	Insufficient
1	002803IN	2.65	3	9.8	11.2	Insufficient
1	002806IN	1.25	3	9.8	6.2	
1	002807IN	1.885	3	9.8	10.4	Insufficient
1	002810IN	1.446	1	3.3	8.2	Insufficient
1	002813IN	2.818	7	22.8	15.0	
1	002817IN	1.111	0	0.0	4.9	Insufficient
1	002819IN	1.214	1	3.3	6.4	Insufficient
1	002820IN	1.565	1	3.3	7.2	Insufficient
1	002821IN	2.815	3	9.8	12.7	Insufficient
1	002822IN	6.426	2	6.5	20.7	Insufficient
1	002823IN	3.729	8	26.0	14.3	
1	002825IN	1.307	1	3.3	6.0	Insufficient
1	002912IN	1.329	9	29.3	7.1	
1	002915IN	2.536	2	6.5	12.3	Insufficient
1	002916IN	0.666	2	6.5	3.5	
1	002921IN	1.379	4	13.0	6.9	
1	002949IN	3.388	1	3.3	12.4	Insufficient
1	004667IN	1.204	4	13.0	5.9	
1	004671IN	3.667	2	6.5	13.1	Insufficient
1	004672IN	2.743	1	3.3	14.2	Insufficient
1	004674IN	1.952	2	6.5	9.6	Insufficient

TABLE 1  
Detailed Inlet Capacity Results for Holmes Run

Sub-shed	Model Load Point	Total Drainage Area (ac)	Total Throat Count	Total Inlet Capacity (cfs)	Peak Runoff (cfs)	Inlet Capacity
1	004676IN	1.033	2	6.5	4.9	
1	004677IN	1.178	1	3.3	5.2	Insufficient
1	004678IN	1.653	2	6.5	8.1	Insufficient
1	004680IN	2.056	5	16.3	8.3	
1	004705IN	3.518	9	29.3	18.7	
1	004707IN	0.413	1	3.3	2.2	
1	004710IN	3.259	3	9.8	14.8	Insufficient
1	004711IN	3.202	8	26.0	17.6	
1	004719IN	0.728	1	3.3	4.1	Insufficient
1	004720IN	2.769	5	16.3	14.1	
1	004726IN	5.088	2	6.5	18.3	Insufficient
1	004731IN	4.318	10	32.5	19.6	
1	004741IN	7.35	11	35.8	32.3	
1	004743IN	1.999	1	3.3	10.0	Insufficient
1	004750IN	0.852	1	3.3	4.0	Insufficient
1	004753IN	4.995	2	6.5	23.4	Insufficient
1	004754IN	1.007	1	3.3	4.8	Insufficient
1	004755IN	3.644	1	3.3	16.9	Insufficient
1	004757IN	4.45	3	9.8	17.3	Insufficient
1	004766IN	6.101	5	16.3	16.0	
1	004775IN	1.968	2	6.5	9.2	Insufficient
1	004778IN	4.731	5	16.3	24.5	Insufficient
1	004781IN	2.004	2	6.5	10.2	Insufficient
1	004784IN	2.877	1	3.3	14.9	Insufficient
1	004785IN	0.584	1	3.3	3.2	
2	000002PD	1.524	0	0.0	6.6	Insufficient
2	000003PD	12.807	9	29.3	59.7	Insufficient
2	000113IO	2.397	0	0.0	7.4	Insufficient
2	000117IO	4.799	0	0.0	12.3	Insufficient
2	000136IO	3.993	0	0.0	19.2	Insufficient
2	000254ND	12.544	0	0.0	49.1	Insufficient
2	000338ND	14.251	0	0.0	59.5	Insufficient
2	000362ND	1.291	0	0.0	6.8	Insufficient
2	000363ND	6.42	0	0.0	30.5	Insufficient
2	000502SMH	2.396	6	19.5	9.8	
2	000512SMH	1.018	4	13.0	4.8	
2	000513SMH	1.42	1	3.3	5.9	Insufficient
2	000522SMH	2.309	1	3.3	7.5	Insufficient
2	000524SMH	3.011	10	32.5	11.8	
2	000526SMH	5.005	5	16.3	13.1	
2	000546SMH	0.811	0	0.0	4.6	Insufficient
2	000547SMH	1.745	0	0.0	10.5	Insufficient
2	000574SMH	1.756	4	13.0	8.0	
2	000643SMH	1.152	6	19.5	5.5	
2	000644SMH	4.287	6	19.5	21.6	Insufficient
2	000645SMH	0.754	3	9.8	3.3	
2	000646SMH	2.903	1	3.3	12.9	Insufficient
2	000648SMH	0.563	0	0.0	3.1	Insufficient
2	000649SMH	3.378	6	19.5	15.1	
2	000652SMH	1.317	1	3.3	7.6	Insufficient
2	000654SMH	2.908	1	3.3	14.5	Insufficient
2	000663SMH	1.565	1	3.3	7.2	Insufficient
2	000664SMH	1.555	3	9.8	8.1	

TABLE 1  
Detailed Inlet Capacity Results for Holmes Run

Sub-shed	Model Load Point	Total Drainage Area (ac)	Total Throat Count	Total Inlet Capacity (cfs)	Peak Runoff (cfs)	Inlet Capacity
2	000911SMH	1.493	1	3.3	7.2	Insufficient
2	000913SMH	4.442	2	6.5	16.3	Insufficient
2	000915SMH	8.342	6	19.5	32.4	Insufficient
2	000921SMH	1.911	0	0.0	9.3	Insufficient
2	001010SMH	0.899	7	22.8	5.0	
2	001535IN	0.816	4	13.0	4.4	
2	001544IN	1.493	1	3.3	3.9	Insufficient
2	001545IN	1.049	1	3.3	4.2	Insufficient
2	001546IN	2.025	3	9.8	6.0	
2	001551IN	1.074	3	9.8	5.2	
2	001553IN	1.043	2	6.5	4.6	
2	001555IN	1.56	2	6.5	6.8	Insufficient
2	001561IN	3.559	9	29.3	11.8	
2	001568IN	0.847	4	13.0	3.1	
2	001585IN	1.111	3	9.8	4.9	
2	001593IN	3.342	4	13.0	11.5	
2	001596IN	1.265	1	3.3	5.1	Insufficient
2	001620IN	1.131	2	6.5	6.0	
2	001623IN	0.801	2	6.5	3.1	
2	001624IN	1.737	3	9.8	8.4	
2	001631IN	11.631	17	55.3	32.4	
2	001922IN	1.839	1	3.3	7.1	Insufficient
2	001924IN	0.925	2	6.5	5.2	
2	001933IN	2.299	4	13.0	12.2	
2	001936IN	0.899	3	9.8	5.3	
2	001940IN	0.987	2	6.5	5.1	
2	001947IN	1.095	2	6.5	5.8	
2	001948IN	2.454	4	13.0	12.3	
2	001951IN	3.047	1	3.3	15.6	Insufficient
2	001952IN	0.842	2	6.5	4.5	
2	001953IN	1.405	3	9.8	7.4	
2	001960IN	1.586	3	9.8	8.2	
2	001962IN	2.18	4	13.0	11.4	
2	001963IN	14.261	11	35.8	64.9	Insufficient
2	001964IN	3.45	2	6.5	18.4	Insufficient
2	001975IN	1.049	4	13.0	5.7	
2	001979IN	2.138	4	13.0	10.6	
2	001983IN	1.539	4	13.0	7.8	
2	001991IN	1.56	3	9.8	7.7	
2	001993IN	1.245	4	13.0	5.9	
2	001996IN	4.189	6	19.5	18.5	
2	002010IN	4.855	9	29.3	21.4	
2	002013IN	0.883	3	9.8	4.2	
2	002019IN	1.142	4	13.0	6.4	
2	002020IN	1.147	1	3.3	6.1	Insufficient
2	002029IN	4.731	11	35.8	20.1	
2	002031IN	1.234	2	6.5	6.0	
2	002930IN	1.322	2	6.5	7.6	Insufficient
2	002945IN	1.451	6	19.5	7.0	
2	002952IN	3.614	2	6.5	19.9	Insufficient
2	002957IN	2.118	4	13.0	10.9	
2	002960IN	0.904	1	3.3	4.6	Insufficient
2	002961IN	2.268	1	3.3	11.4	Insufficient

TABLE 1  
Detailed Inlet Capacity Results for Holmes Run

Sub-shed	Model Load Point	Total Drainage Area (ac)	Total Throat Count	Total Inlet Capacity (cfs)	Peak Runoff (cfs)	Inlet Capacity
2	002962IN	2.634	2	6.5	12.9	Insufficient
2	002963IN	0.511	0	0.0	2.7	Insufficient
2	003011IN	6.834	6	19.5	29.1	Insufficient
2	004053SMH	1.239	0	0.0	7.3	Insufficient
3	000281ND	1.865	2	6.5	9.2	Insufficient
3	000282ND	1.281	0	0.0	6.6	Insufficient
3	000283ND	5.336	6	19.5	23.9	Insufficient
3	000286ND	2.706	1	3.3	12.8	Insufficient
3	000288ND	1.539	4	13.0	8.3	
3	000316IO	14.641	5	16.3	32.5	Insufficient
3	000323IO	6.99	1	3.3	34.5	Insufficient
3	000334ND	4.148	1	3.3	17.0	Insufficient
3	000379ND	0.95	0	0.0	3.4	Insufficient
3	000399ND	3.311	0	0.0	16.0	Insufficient
3	000571ND	2.991	0	0.0	11.4	Insufficient
3	000681SMH	2.469	1	3.3	14.1	Insufficient
3	000716SMH	2.216	3	9.8	12.5	Insufficient
3	000747SMH	1.296	4	13.0	7.2	
3	000751SMH	4.163	6	19.5	16.2	
3	000753SMH	0.852	0	0.0	3.7	Insufficient
3	000754SMH	1.761	2	6.5	7.7	Insufficient
3	000755SMH	1.756	0	0.0	5.0	Insufficient
3	000760SMH	1.565	0	0.0	6.2	Insufficient
3	000761SMH	4.555	6	19.5	15.3	
3	000764SMH	4.096	0	0.0	16.5	Insufficient
3	000766SMH	8.74	0	0.0	35.8	Insufficient
3	000768SMH	0.77	2	6.5	4.3	
3	000769SMH	4.705	1	3.3	20.5	Insufficient
3	000775SMH	1.426	6	19.5	7.3	
3	000779SMH	0.775	0	0.0	4.5	Insufficient
3	000786SMH	6.472	4	13.0	27.9	Insufficient
3	000873SMH	5.057	9	29.3	14.3	
3	000874SMH	6.333	3	9.8	20.0	Insufficient
3	000878SMH	1.002	0	0.0	3.0	Insufficient
3	000890SMH	2.96	1	3.3	11.1	Insufficient
3	000922SMH	0.956	4	13.0	4.9	
3	000925SMH	4.225	10	32.5	16.2	
3	000927SMH	6.689	14	45.5	22.4	
3	000930SMH	1.746	8	26.0	7.4	
3	000931SMH	0.899	3	9.8	4.5	
3	000936SMH	1.209	4	13.0	3.5	
3	000938SMH	4.799	12	39.0	22.4	
3	000943SMH	7.717	5	16.3	25.7	Insufficient
3	000944SMH	1.544	3	9.8	7.1	
3	000945SMH	8.471	0	0.0	23.9	Insufficient
3	000946SMH	2.593	8	26.0	10.7	
3	000947SMH	0.878	2	6.5	4.5	
3	000948SMH	0.873	4	13.0	3.8	
3	000949SMH	3.222	3	9.8	16.6	Insufficient
3	000953SMH	1.028	2	6.5	4.9	
3	000954SMH	1.715	2	6.5	7.4	Insufficient
3	000955SMH	0.919	0	0.0	4.1	Insufficient
3	000957SMH	2.748	3	9.8	12.6	Insufficient

TABLE 1  
Detailed Inlet Capacity Results for Holmes Run

Sub-shed	Model Load Point	Total Drainage Area (ac)	Total Throat Count	Total Inlet Capacity (cfs)	Peak Runoff (cfs)	Inlet Capacity
3	000959SMH	1.498	3	9.8	6.5	
3	000965SMH	4.411	6	19.5	15.2	
3	000988SMH	2.061	3	9.8	9.1	
3	000994SMH	1.018	2	6.5	5.5	
3	000998SMH	1.317	2	6.5	6.9	Insufficient
3	001004SMH	16.338	15	48.8	60.8	Insufficient
3	001005SMH	2.681	2	6.5	10.0	Insufficient
3	001008SMH	1.317	0	0.0	6.0	Insufficient
3	001009SMH	1.42	0	0.0	5.8	Insufficient
3	001039SMH	1.529	5	16.3	5.7	
3	001044SMH	5.456	13	42.3	21.5	
3	001045SMH	3.161	7	22.8	11.6	
3	001049SMH	1.539	0	0.0	5.1	Insufficient
3	001052SMH	1.57	10	32.5	6.6	
3	001055SMH	1.999	6	19.5	6.6	
3	001061SMH	2.536	2	6.5	8.3	Insufficient
3	001063SMH	4.334	9	29.3	13.2	
3	001065SMH	2.944	7	22.8	10.9	
3	001068SMH	8.889	5	16.3	38.4	Insufficient
3	001071SMH	3.015	9	29.3	16.1	
3	001074SMH	3.4	8	26.0	16.5	
3	001092SMH	2.603	9	29.3	8.7	
3	001094SMH	5.408	11	35.8	15.6	
3	001096SMH	0.713	0	0.0	3.8	Insufficient
3	001216SMH	3.378	9	29.3	11.5	
3	001454SMH	1.457	2	6.5	6.7	Insufficient
3	001456SMH	3.37	3	9.8	14.8	Insufficient
3	001458SMH	3.819	3	9.8	20.7	Insufficient
3	001459SMH	4.204	1	3.3	16.6	Insufficient
3	001461SMH	4.84	4	13.0	15.7	Insufficient
3	001479SMH	1.498	3	9.8	6.6	
3	001480SMH	2.774	5	16.3	11.4	
3	002032IN	3.042	3	9.8	9.6	
3	002110IN	1.395	9	29.3	7.5	
3	002124IN	2.438	3	9.8	12.9	Insufficient
3	002209IN	1.426	3	9.8	4.6	
3	002212IN	10.046	7	22.8	32.7	Insufficient
3	002222IN	2.268	4	13.0	7.8	
3	002223IN	2.231	1	3.3	8.3	Insufficient
3	002236IN	0.894	4	13.0	4.6	
3	002237IN	0.904	1	3.3	4.0	Insufficient
3	002239IN	3.383	5	16.3	16.7	Insufficient
3	002243IN	4.969	4	13.0	21.9	Insufficient
3	002246IN	4.008	2	6.5	18.0	Insufficient
3	002252IN	3.993	5	16.3	16.0	
3	002253IN	1.162	4	13.0	5.1	
3	002260IN	2.386	1	3.3	9.6	Insufficient
3	002261IN	2.66	0	0.0	12.4	Insufficient
3	002263IN	3.543	2	6.5	16.6	Insufficient
3	002264IN	1.369	1	3.3	7.1	Insufficient
3	002272IN	6.24	1	3.3	25.1	Insufficient
3	002273IN	0.79	2	6.5	2.8	
3	002275IN	2.268	2	6.5	8.7	Insufficient

TABLE 1  
Detailed Inlet Capacity Results for Holmes Run

Sub-shed	Model Load Point	Total Drainage Area (ac)	Total Throat Count	Total Inlet Capacity (cfs)	Peak Runoff (cfs)	Inlet Capacity
3	002279IN	3.869	3	9.8	17.4	Insufficient
3	002290IN	2.392	6	19.5	13.8	
3	002296IN	1.364	5	16.3	7.9	
3	002297IN	2.04	1	3.3	11.9	Insufficient
3	002559IN	2.908	3	9.8	14.2	Insufficient
3	002562IN	2.469	5	16.3	10.1	
3	002565IN	1.901	3	9.8	10.3	Insufficient
3	002566IN	1.364	1	3.3	7.7	Insufficient
3	002572IN	1.689	0	0.0	6.0	Insufficient
3	002602IN	4.411	9	29.3	15.3	
3	002647IN	4.721	1	3.3	15.9	Insufficient
3	002654IN	1.591	9	29.3	7.2	
3	002657IN	1.555	3	9.8	7.0	
3	002660IN	2.464	1	3.3	10.7	Insufficient
3	002668IN	1.596	3	9.8	7.0	
3	002672IN	6.08	7	22.8	17.0	
3	002677IN	2.619	5	16.3	10.1	
3	002679IN	1.121	0	0.0	5.4	Insufficient
3	002681IN	2.448	5	16.3	10.5	
3	002687IN	2.691	3	9.8	11.0	Insufficient
3	002688IN	3.206	2	6.5	18.9	Insufficient
3	002691IN	2.173	2	6.5	8.7	Insufficient
3	002693IN	1.307	6	19.5	5.6	
3	002694IN	3.213	1	3.3	12.8	Insufficient
3	002702IN	3.497	11	35.8	14.2	
3	002721IN	3.481	4	13.0	11.8	
3	002723IN	0.723	3	9.8	3.9	
3	002724IN	1.389	2	6.5	6.5	
3	002726IN	2.738	1	3.3	11.0	Insufficient
3	002727IN	3.384	1	3.3	12.7	Insufficient
3	002729IN	0.785	3	9.8	4.3	
3	002730IN	0.899	0	0.0	4.3	Insufficient
3	002731IN	1.054	1	3.3	4.5	Insufficient
3	002732IN	1.508	0	0.0	6.1	Insufficient
3	002733IN	0.826	1	3.3	4.1	Insufficient
3	002734IN	1.069	0	0.0	5.6	Insufficient
3	002739IN	5.036	7	22.8	24.4	Insufficient
3	002746IN	0.506	1	3.3	2.6	
3	002751IN	1.085	0	0.0	3.3	Insufficient
3	002752IN	3.275	0	0.0	12.9	Insufficient
3	002842IN	4.566	4	13.0	16.2	Insufficient
3	002967IN	3.394	7	22.8	15.1	
3	002981IN	33.087	20	65.1	36.9	
3	002999IN	9.308	2	6.5	20.9	Insufficient
3	003002IN	1.312	1	3.3	6.0	Insufficient
3	003019IN	3.14	6	19.5	15.0	
3	003020IN	1.601	0	0.0	6.7	Insufficient
3	003022IN	1.204	1	3.3	6.2	Insufficient
3	003138IN	1.214	2	6.5	5.4	
3	003147IN	5.863	12	39.0	20.6	
3	003152IN	2.908	6	19.5	13.6	
3	003158IN	2.149	2	6.5	11.0	Insufficient
3	003159IN	0.842	2	6.5	3.6	

TABLE 1  
Detailed Inlet Capacity Results for Holmes Run

Sub-shed	Model Load Point	Total Drainage Area (ac)	Total Throat Count	Total Inlet Capacity (cfs)	Peak Runoff (cfs)	Inlet Capacity
3	003161IN	2.025	7	22.8	10.5	
3	003167IN	1.369	1	3.3	5.8	Insufficient
3	003169IN	1.147	3	9.8	5.2	
3	003171IN	13.264	10	32.5	28.0	
3	003181IN	4.406	2	6.5	10.9	Insufficient
3	003182IN	3.14	5	16.3	12.0	
3	003185IN	1.89	1	3.3	6.0	Insufficient
3	003189IN	3.611	5	16.3	11.8	
3	003202IN	3.171	7	22.8	11.9	
3	003205IN	1.033	1	3.3	4.8	Insufficient
3	003214IN	5.692	8	26.0	17.6	
3	003221IN	1.338	4	13.0	6.0	
3	003229IN	2.975	2	6.5	9.6	Insufficient
3	003234IN	1.906	10	32.5	8.6	
3	003257IN	5.372	5	16.3	16.3	Insufficient
3	003282IN	2.149	1	3.3	10.1	Insufficient
3	003304IN	0.987	1	3.3	4.6	Insufficient
3	003307IN	5.15	5	16.3	20.6	Insufficient
3	003310IN	0.961	2	6.5	3.9	
3	003321IN	2.059	7	22.8	10.0	
3	003365IN	1.699	1	3.3	7.5	Insufficient
3	003367IN	0.976	3	9.8	5.2	
3	003368IN	2.505	1	3.3	13.0	Insufficient
3	003371IN	0.971	5	16.3	5.9	
3	003373IN	5.894	6	19.5	25.6	Insufficient
3	003813IN	5.95	3	9.8	11.0	Insufficient
3	003844IN	1.193	2	6.5	4.9	
3	003898IN	2.727	4	13.0	10.7	
3	003900IN	5.558	8	26.0	14.5	
3	003902IN	1.844	2	6.5	4.8	
3	004534IN	1.343	3	9.8	5.2	
3	004535IN	1.803	1	3.3	7.5	Insufficient
3	004536IN	1.255	4	13.0	6.0	
3	004539IN	3.373	3	9.8	13.2	Insufficient
3	004549IN	1.348	4	13.0	4.6	
3	004567IN	0.976	1	3.3	3.7	Insufficient
3	004574IN	1.627	6	19.5	7.0	
3	004584IN	1.581	6	19.5	6.5	
3	004587IN	2.872	5	16.3	10.9	
3	009929IN	23.306	2	6.5	90.5	Insufficient
4	000280IO	7.397	2	6.5	32.9	Insufficient
4	000484ND	1.798	0	0.0	8.6	Insufficient
4	000551ND	1.131	1	3.3	6.6	Insufficient
4	000552ND	0.899	0	0.0	5.3	Insufficient
4	000553ND	1.142	1	3.3	6.5	Insufficient
4	001080SMH	1.88	3	9.8	9.5	
4	001081SMH	1.741	3	9.8	8.3	
4	001085SMH	0.837	0	0.0	4.2	Insufficient
4	001087SMH	2.164	1	3.3	10.8	Insufficient
4	001089SMH	2.743	1	3.3	11.0	Insufficient
4	001230SMH	1.632	2	6.5	8.7	Insufficient
4	001234SMH	3.27	4	13.0	17.5	Insufficient
4	001255SMH	1.477	0	0.0	7.8	Insufficient

TABLE 1  
Detailed Inlet Capacity Results for Holmes Run

Sub-shed	Model Load Point	Total Drainage Area (ac)	Total Throat Count	Total Inlet Capacity (cfs)	Peak Runoff (cfs)	Inlet Capacity
4	001259SMH	1.302	4	13.0	7.2	
4	001272SMH	3.286	2	6.5	18.3	Insufficient
4	001325SMH	1.384	1	3.3	8.1	Insufficient
4	001341SMH	1.296	0	0.0	7.4	Insufficient
4	001358SMH	2.34	2	6.5	12.4	Insufficient
4	001360SMH	1.684	0	0.0	8.6	Insufficient
4	001371SMH	1.627	0	0.0	9.5	Insufficient
4	001379SMH	1.767	4	13.0	10.2	
4	003331IN	33.414	2	6.5	177.9	Insufficient
4	003342IN	0.961	3	9.8	5.3	
4	003818IN	0.811	2	6.5	4.0	
4	003822IN	1.958	2	6.5	10.1	Insufficient
4	003826IN	2.485	4	13.0	12.5	
4	003827IN	1.338	5	16.3	6.3	
4	003831IN	4.54	3	9.8	23.8	Insufficient
4	003840IN	0.785	3	9.8	4.4	
4	003842IN	0.919	3	9.8	5.3	
4	003852IN	4.163	7	22.8	19.4	
4	003854IN	6.632	8	26.0	30.8	Insufficient
4	003857IN	1.364	3	9.8	7.3	
4	003875IN	2.066	1	3.3	10.6	Insufficient
4	003880IN	3.337	8	26.0	17.8	
4	003909IN	1.617	2	6.5	8.6	Insufficient
4	003911IN	2.304	1	3.3	11.9	Insufficient
4	003917IN	6.214	2	6.5	30.5	Insufficient
4	003918IN	0.868	1	3.3	4.5	Insufficient
4	003919IN	3.13	3	9.8	15.7	Insufficient
4	003924IN	3.11	7	22.8	12.5	
4	003935IN	3.187	6	19.5	17.9	
4	003937IN	9.179	2	6.5	46.0	Insufficient
4	003939IN	1.658	2	6.5	9.5	Insufficient
4	004231IN	1.803	4	13.0	9.8	
4	004236IN	1.162	2	6.5	6.8	Insufficient
4	004239IN	1.952	2	6.5	11.1	Insufficient
4	004240IN	1.074	0	0.0	6.3	Insufficient
4	004242IN	2.33	4	13.0	9.2	
4	004249IN	2.138	3	9.8	11.9	Insufficient
4	004251IN	2.764	1	3.3	16.0	Insufficient
4	004253IN	1.637	1	3.3	9.4	Insufficient
4	004255IN	3.182	2	6.5	16.5	Insufficient
4	004280IN	1.42	2	6.5	6.2	
4	004281IN	3.43	3	9.8	18.3	Insufficient
4	004284IN	3.889	5	16.3	22.1	Insufficient

**Attachment D**  
**Detailed Model Results**

---



TABLE 1

## Holmes Run Detailed Hydraulic Model Results

Subshed	DGravityMain FacilityID	Junction FacilityID			Diameter/ Height x Width (ft)	Maximum Flow (ft³/s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft³)		Summary Pipe Condition
		US	DS	Length (ft)				US	DS	US	DS	US	DS	US	DS	US	DS	
1	000910STMP	000503SMH	001525IN	63	5	117.28	17.31	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	000911STMP	001526IN	000503SMH	49	3.5	57.23	26.09	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	000916STMP	002923IN	000189IO	201	5.5	281.95	23.34	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	000918STMP	002912IN	002923IN	70	4.5	281.01	17.1	0	0	0.4	-	-	-	0.0	0.0	0	0	Surcharged
1	000919STMP	000904SMH	002906IN	168	3.5	179.24	22.91	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	000920STMP	002825IN	002819IN	72	1.25	6	17.65	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	000941A	000504SMH	000228ND	298	1.75	19.86	13.63	0	0.1	-	0.1	-	-	0.0	0.0	0	0	Sufficient Capacity
1	000941B	000228ND	000507SMH	35	1.75	19.89	8.09	0.1	0	0.1	-	-	-	0.0	0.0	0	0	Surcharged
1	001113STMP	002916IN	002914IN	155	3.5	238.83	29.2	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	001114STMP	000906SMH	002916IN	101	2.25	59.72	18.31	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	002030STMP	001525IN	000109IO	106	6	121.98	15.47	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	002061STMP	002914IN	000905SMH	399	3.5	257.12	29.56	0	0	-	0.1	-	-	0.0	0.0	0	0	Sufficient Capacity
1	002062STMP	000905SMH	002912IN	182	4.5	273.97	19.27	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	002063STMP	000909SMH	000191IO	114	1.75	49.65	24.25	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	002303STMP	000507SMH	000508SMH	209	1.5	19.89	15.57	0	0.2	-	1.6	-	1.0	0.0	0.0	0	0	Sufficient Capacity
1	002307STMP	000508SMH	001534IN	84	1.5	19.91	11.71	0.2	0	1.8	-	1.0	-	0.0	0.0	0	0	Insufficient Freeboard
1	002308STMP	001534IN	000111IO	133	1.75	26.97	24.84	0	0	-	-	-	1.7	0.0	0.0	0	0	Sufficient Capacity
1	002577STMP	000902SMH	002822IN	24	1.75	28.98	11.61	0.4	0	0.3	-	-	-	0.0	0.0	0	0	Surcharged
1	002578STMP	002822IN	000909SMH	166	1.75	49.62	24.34	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	002579STMP	002778IN	002779IN	332	2	55.36	17.2	0.1	0	Flooded	1.3	Flooded	-	0.1	0.0	19	0	Flooded
1	002580STMP	002779IN	000977SMH	37	2.5	75.15	17.18	0	0.1	1.0	0.9	-	-	0.0	0.0	0	0	Surcharged
1	002581STMP	000977SMH	002824IN	150	2.5	73.77	18.27	0.1	0.1	0.9	2.2	-	0.6	0.0	0.0	0	0	Surcharged
1	002582STMP	002824IN	002786IN	141	2.5	99.4	21.13	0.1	0.2	2.2	1.5	0.6	2.0	0.0	0.0	0	0	Insufficient Freeboard
1	002583STMP	002786IN	000978SMH	41	2.5	103.67	21.08	0.2	0.1	1.5	0.8	2.0	-	0.0	0.0	0	0	Insufficient Freeboard
1	002584STMP	002801IN	002803IN	200	2.5	116.03	25.79	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	002585STMP	000978SMH	002801IN	181	2.5	106.41	23.01	0.1	0	1.1	-	-	-	0.0	0.0	0	0	Surcharged
1	002586STMP	002813IN	002816IN	42	1.5	33.05	18.45	0	0.6	3.2	3.0	1.2	-	0.0	0.0	0	0	Insufficient Freeboard
1	002587STMP	002803IN	002817IN	129	2.5	127.19	30.35	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	002594STMP	002917IN	000906SMH	17	2.25	59.7	24.84	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	002597STMP	000908SMH	002914IN	73	1.25	6.94	10.86	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	002736STMP	000340ND	002947IN	67	1.75	23.74	18.23	0	0.2	-	Flooded	1.1	Flooded	0.0	0.1	0	823	Sufficient Capacity
1	002737STMP	002948IN	002949IN	166	1.25	13.78	10.98	0.2	0.1	Flooded	2.1	Flooded	-	0.1	0.0	46	0	Flooded
1	002738STMP	002949IN	002824IN	163	1.75	26.07	12.34	0.1	0.1	1.6	2.7	-	0.6	0.0	0.0	0	0	Surcharged
1	002803STMP	000966SMH	000967SMH	34	1.5	9.36	7.97	0.1	0.1	2.3	3.0	0.5	0.2	0.0	0.0	0	0	Insufficient Freeboard
1	002804STMP	000971SMH	000966SMH	84	1.25	9.49	14.46	0	0.1	-	2.4	0.7	0.5	0.0	0.0	0	0	Sufficient Capacity
1	002806STMP	000967SMH	000968SMH	275	1.5	24.38	13.62	0.1	0.8	3.0	Flooded	0.2	Flooded	0.0	0.8	0	11948	Insufficient Freeboard
1	002807STMP	002760IN	000968SMH	24	1.25	7.73	11.79	0.8	0.8	1.5	Flooded	0.8	Flooded	0.0	0.8	0	11948	Insufficient Freeboard
1	002808STMP	002761IN	000969SMH	8	1.25	8.37	8.78	0.5	0.5	2.6	3.3	0.9	0.1	0.0	0.0	0	0	Insufficient Freeboard
1	002810STMP	000968SMH	000969SMH	158	1.25	18.15	14.52	0.8	0.5	Flooded	3.5	Flooded	0.1	0.8	0.0	11948	0	Flooded
1	002811STMP	000969SMH	000970SMH	173	1.75	28.98	11.91	0.5	0.5	3.4	2.0	0.1	-	0.0	0.0	0	0	Insufficient Freeboard
1	002814STMP	002763IN	002761IN	49	1.25	8.36	7.35	0.4	0.5	Flooded	2.6	Flooded	0.9	0.4	0.0	1447	0	Flooded
1	002881STMP	002947IN	000903SMH	120	2	25.67	12.23	0.2	0.2	Flooded	5.5	Flooded	-	0.1	0.0	823	0	Flooded
1	002882STMP	000903SMH	000976SMH	57	2	42.77	18.28	0.2	0.2	5.5</								

TABLE 1

## Holmes Run Detailed Hydraulic Model Results

Subshed	DGravityMain FacilityID	Junction FacilityID			Diameter/ Height x Width (ft)	Maximum Flow (ft³/s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft³)		Summary Pipe Condition		
		US	DS	Length (ft)				US	DS	US	DS	US	DS	US	DS	US	DS			
1	004468STMP	002794IN	002820IN	256	2	49.72	24.79	0	0.3	-	-	Flooded	-	-	0.0	0.3	0	2667	Sufficient Capacity	
1	004469STMP	002795IN	002794IN	75	2	33.83	11.44	0	0	-	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
1	004471STMP	000339ND	000979SMH	94	1.75	19.66	8.75	0	0	-	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
1	004473STMP	002799IN	002794IN	49	1.25	8.58	11.74	0	0	-	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
1	004474STMP	002800IN	002801IN	9	1.25	9.67	7.88	0.3	0	0.6	-	1.2	-	-	0.0	0.0	0	0	Insufficient Freeboard	
1	004476STMP	002806IN	000980SMH	10	1.25	6.16	15.22	0	0	-	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
1	004478STMP	002797IN	002795IN	136	1.75	19.65	10.54	0	0	-	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
1	004479STMP	000979SMH	002797IN	93	1.75	19.66	9.62	0	0	-	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
1	004484STMP	002807IN	002809IN	174	1.25	10.39	12.93	0	0	-	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
1	004486STMP	002810IN	002809IN	108	1.25	8.2	16.74	0	0	-	-	1.3	-	-	0.0	0.0	0	0	Sufficient Capacity	
1	004487STMP	002811IN	002813IN	95	1.5	18.52	10.36	0.2	0	Flooded	1.4	Flooded	1.2	0.0	0.0	0	1	0	Flooded	
1	004491STMP	002816IN	000194IO	24	1.5	-33.06	18.5	0.6	0	3.0	-	-	0.9	0.0	0.0	0	0	0	Surcharged	
1	004492STMP	002809IN	002811IN	191	1.5	18.53	13.88	0	0.2	-	Flooded	-	Flooded	0.0	0.0	0	1	0	Sufficient Capacity	
1	004493STMP	002817IN	000981SMH	97	3	132.51	19.23	0	0	0.5	-	-	-	0.0	0.0	0	0	Surcharged		
1	004494STMP	000981SMH	002818IN	155	3.5	143.22	17.5	0	0	-	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
1	004495STMP	002820IN	000901SMH	51	2	48.76	15.27	0.3	0.4	Flooded	4.2	Flooded	-	0.3	0.0	2667	0	0	Flooded	
1	004496STMP	000901SMH	002821IN	86	2	48.77	15.34	0.4	0.4	4.2	2.4	-	-	0.0	0.0	0	0	0	Surcharged	
1	004497STMP	002821IN	000983SMH	101	2.25	59.69	14.91	0.4	0	2.6	-	-	-	0.0	0.0	0	0	0	Surcharged	
1	004498STMP	000980SMH	002818IN	141	1.25	6.15	16.75	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	004499STMP	000982SMH	000904SMH	141	3.5	161.35	23.2	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	004500STMP	002819IN	000982SMH	118	3.5	161.11	22.68	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	004503STMP	002818IN	002819IN	266	3.5	148.81	21.58	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	004504STMP	000970SMH	000902SMH	222	1.75	28.98	11.92	0.5	0.4	2.2	0.1	-	-	0.0	0.0	0	0	0	Surcharged	
1	004505STMP	000983SMH	002917IN	156	2.25	59.69	17.19	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	004506STMP	002915IN	002914IN	52	2	12.23	5.96	0	0	-	-	1.0	-	-	0.0	0.0	0	0	0	Sufficient Capacity
1	004508STMP	002921IN	000908SMH	39	1.25	6.94	12.51	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	004768STMP	004671IN	004669IN	219	1.25	13.06	15.6	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	004769STMP	004672IN	000330IO	39	4	212.37	26.93	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	004771STMP	004674IN	004675IN	66	1.25	9.62	14.84	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	004772STMP	004675IN	001521SMH	118	3.5	165.73	21.8	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	004773STMP	004676IN	004675IN	159	3.5	155.99	21.7	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	004775STMP	004678IN	001520SMH	137	2	41.41	21.61	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	004776STMP	004677IN	004676IN	71	1.25	5.22	13.04	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	004777STMP	001520SMH	004676IN	205	3.5	145.6	21.73	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	006187STMP	004679IN	004678IN	301	2	33.41	20.3	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	006188STMP	004775IN	004679IN	150	2	25.21	13.06	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	006189STMP	004680IN	004679IN	86	1.25	8.27	12.33	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	006451STMP	001514SMH	004738IN	122	1.25	18.2	14.63	0.2	0	3.0	-	-	-	0.0	0.0	0	0	0	Surcharged	
1	006452STMP	004710IN	001515SMH	189	2.5	74.77	23.93	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	006454STMP	004738IN	004742IN	216	1.25	18.2	18.62	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity	
1	006457STMP	004741IN	001516SMH	33	1.5	32.14	32.23	0	0.1	-	6.9	-	1.2	0.0	0.0	0	0	0	Sufficient Capacity	
1	006458STMP	001516SMH	004744IN	86	1.5	-31.36	16.9	0.1	0.1	13.8	Flooded	1.2	Flooded	0.0	0.0	0	28	0	Insufficient Freeboard	
1	006459STMP	004742IN	001518SMH	113	1.5	18.2	18.94</td													

TABLE 1

## Holmes Run Detailed Hydraulic Model Results

Subshed	DGravityMain FacilityID	Junction FacilityID			Diameter/ Height x Width (ft)	Maximum Flow (ft³/s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft³)		Summary Pipe Condition
		US	DS	Length (ft)				US	DS	US	DS	US	DS	US	DS	US	DS	
1	006467STMP	004749IN	004665IN	28	1.5	-34.03	19.63	1.8	0	4.6	-	2.0	-	0.0	0.0	0	0	Insufficient Freeboard
1	006468STMP	004750IN	004749IN	123	1.25	4	7.75	0	1.8	-	4.2	-	2.0	0.0	0.0	0	0	Sufficient Capacity
1	006469STMP	001517SMH	001519SMH	124	1.75	32.78	23.33	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006470STMP	001518SMH	001517SMH	114	1.5	27.56	18.89	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006750STMP	004704IN	004705IN	5	1	0	0	0	0	-	0.2	1.7	-	0.0	0.0	0	0	Sufficient Capacity
1	006751STMP	004705IN	004718IN	99	1.75	18.58	10.4	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006752STMP	001509SMH	004706IN	126	1.25	-10.07	8.04	0.6	0.1	4.4	1.1	-	1.8	0.0	0.0	0	0	Surcharged
1	006754STMP	004706IN	001511SMH	17	1.25	10.09	8.18	0.1	0.1	1.1	0.9	1.8	1.9	0.0	0.0	0	0	Insufficient Freeboard
1	006758STMP	001511SMH	004707IN	44	1.5	25.89	16.35	0.1	0.2	0.8	1.4	1.9	-	0.0	0.0	0	0	Insufficient Freeboard
1	006759STMP	004707IN	004708IN	87	1.75	28.05	11.61	0.2	0	1.3	-	-	-	0.0	0.0	0	0	Surcharged
1	006760STMP	004708IN	004709IN	206	2	59.94	20.26	0	0	0.2	-	-	-	0.0	0.0	0	0	Surcharged
1	006761STMP	004719IN	004708IN	77	2	32.64	13.99	0	0	-	0.2	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006762STMP	004709IN	004710IN	154	2	60.18	19.54	0	0	2.2	-	-	-	0.0	0.0	0	0	Surcharged
1	006764STMP	004711IN	004712IN	124	1.25	10.18	8.17	0.7	0.6	Flooded	1.5	Flooded	1.0	0.2	0.0	326	0	Flooded
1	006767STMP	004716IN	004717IN	21	1.5	10.11	6.05	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006768STMP	004717IN	004718IN	39	1.25	10.14	10.32	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006769STMP	004718IN	004719IN	155	2	28.67	14.87	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006770STMP	004720IN	004724IN	180	1.25	14.03	12.65	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006775STMP	004724IN	004725IN	239	1.5	14.02	18.03	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006776STMP	004725IN	004726IN	141	1.5	14.02	15.51	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006781STMP	004731IN	001514SMH	159	1.25	18.21	15.84	0.1	0.2	3.7	3.0	1.3	-	0.0	0.0	0	0	Insufficient Freeboard
1	006787STMP	001519SMH	004672IN	308	4	198.7	26.45	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006788STMP	004752IN	001519SMH	17	4	165.94	13.61	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006789STMP	004753IN	004752IN	228	4	165.89	18.74	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006790STMP	004754IN	004753IN	227	4	142.92	21.1	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006792STMP	004755IN	004754IN	198	4	138.42	19.19	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006793STMP	004756IN	004755IN	130	4	122.67	9.74	0.1	0	1.0	-	-	-	0.0	0.0	0	0	Surcharged
1	006794STMP	004757IN	004756IN	133	4	123.17	15.58	0	0.1	-	0.7	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006795STMP	004758IN	004757IN	139	4	106.64	17.31	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006796STMP	004759IN	004758IN	164	4	106.82	18.48	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006797STMP	001515SMH	004759IN	89	3	-75.4	10.7	0	0	1.0	-	-	-	0.0	0.0	0	0	Surcharged
1	006798STMP	004726IN	004759IN	110	1.75	32.12	17.6	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006799STMP	004665IN	004666IN	39	1.75	34.03	27.13	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006800STMP	004666IN	004667IN	41	2.5	34.03	10.82	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006801STMP	004667IN	004669IN	170	2.5	39.61	12.58	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006802STMP	004668IN	000329IO	17	2.5	52.11	10.61	0	0	0.0	-	-	-	0.0	0.0	0	0	Surcharged
1	006803STMP	004669IN	004668IN	64	2.5	52.1	11.58	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006807STMP	001521SMH	002916IN	247	3.5	175.74	27.15	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006821STMP	004766IN	001526SMH	127	1.75	16.03	15.27	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006833STMP	001525SMH	001527SMH	88	2.5	36.41	15.41	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006837STMP	001526SMH	004775IN	144	1.75	16.03	14.1	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006838STMP	004778IN	001527SMH	67	1.25	23.57	19.01	0.1	0	2.3	-	-	-	0.0	0.0	0	0	Surcharged
1	006841STMP	001527SMH	001528SMH	204	2.5	59.69	19.94	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006842STMP	001528SMH	004781IN	108	2.5	69.22	22.36	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
1	006845STMP																	

TABLE 1

## Holmes Run Detailed Hydraulic Model Results

Subshed	DGravity	Main FacilityID	Junction FacilityID			Diameter/ Height x Width (ft)	Maximum Flow (ft³/s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft³)		Summary Pipe Condition
			US	DS	Length (ft)				US	DS	US	DS	US	DS	US	DS	US	DS	
1	014985STMP	004712IN	004716IN	117	1.25	10.1	8.14	0.6	0	1.5	0.1	1.0	-	0.0	0.0	0	0	0	Insufficient Freeboard
2	000459STMP	000543SMH	001624IN	105	3.5	31.72	7.41	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
2	000463STMP	001624IN	000544SMH	119	3.5	39.47	7.05	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
2	000464STMP	000544SMH	000545SMH	38	3.5	-39.47	6.27	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
2	000465STMP	000545SMH	000546SMH	126	3.5	42.37	7.61	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
2	000467STMP	001623IN	000545SMH	21	1.25	3.08	7.79	0	0	-	-	0.7	-	0.0	0.0	0	0	0	Sufficient Capacity
2	000468STMP	000546SMH	000547SMH	175	3.5	46.69	6.92	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
2	000469STMP	000547SMH	001620IN	102	3.5	56.51	6.48	0	0.2	-	0.4	-	-	0.0	0.0	0	0	0	Sufficient Capacity
2	000471STMP	001620IN	001621IN	52	3.5	-62.17	6.36	0.2	0	0.4	-	-	-	0.0	0.0	0	0	0	Surcharged
2	000888STMP	001631IN	000543SMH	178	2.25	31.84	7.94	0.1	0	0.5	-	-	-	0.0	0.0	0	0	0	Surcharged
2	000943STMP	000509SMH	000112IO	45	3	-92.95	13.15	0	0	0.8	-	-	1.9	0.0	0.0	0	0	0	Surcharged
2	001231STMP	000649SMH	001931IN	203	1.5	15.46	8.53	0.6	0.5	Flooded	Flooded	Flooded	Flooded	0.5	0.5	3537	2923	Flooded	
2	001233STMP	001933IN	001931IN	62	1.5	12.01	7.36	0.5	0.5	Flooded	Flooded	Flooded	Flooded	0.0	0.5	5	2923	Flooded	
2	001234STMP	001931IN	001940IN	297	1.5	19.4	10.69	0.5	0.2	Flooded	7.1	Flooded	0.9	0.5	0.0	2923	0	Flooded	
2	001239STMP	001936IN	001938IN	90	1.5	5.19	8.66	0.1	0.3	0.0	5.5	-	0.4	0.0	0.0	0	0	Surcharged	
2	001422STMP	000645SMH	000647SMH	66	3	99.79	17.53	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
2	001423STMP	000646SMH	000002PD	40	1.25	-12.79	10.4	55.1	0	3.1	-	1.1	-	0.0	0.0	0	0	0	Insufficient Freeboard
2	001425STMP	000647SMH	001920IN	11	3.5	-133.37	13.32	0	0	0.5	-	-	-	0.0	0.0	0	0	0	Surcharged
2	001426STMP	001920IN	001921IN	94	3.5	133.36	17.03	0	0.1	0.7	1.1	-	-	0.0	0.0	0	0	0	Surcharged
2	001427STMP	001921IN	002031IN	117	3.5	133.39	14.35	0.1	0.2	2.1	2.0	-	-	0.0	0.0	0	0	0	Surcharged
2	001428STMP	000648SMH	000647SMH	251	1.5	15.26	8.54	0.1	0	3.4	-	-	-	0.0	0.0	0	0	0	Surcharged
2	001429STMP	001924IN	000648SMH	67	1.5	5.15	8.66	0	0.1	-	3.4	-	-	0.0	0.0	0	0	0	Sufficient Capacity
2	001430STMP	001922IN	000648SMH	86	1.25	7.02	7.35	0.1	0.1	1.2	1.6	-	-	0.0	0.0	0	0	0	Surcharged
2	002007STMP	000670SMH	002956IN	89	1.75	50.04	21.67	0.2	0.4	4.0	Flooded	0.1	Flooded	0.0	0.3	0	2154	Insufficient Freeboard	
2	002019STMP	001515IN	001516IN	12	1	0	0	0	0	-	-	1.5	-	0.0	0.0	0	0	0	Sufficient Capacity
2	002020STMP	001516IN	000502SMH	3	1.25	0.03	-1.5	0	0	0.8	-	-	-	0.0	0.0	0	0	0	Surcharged
2	002023A	000502SMH	000231ND	52	1.5	9.8	14.13	0	0	-	-	-	1.9	0.0	0.0	0	0	Sufficient Capacity	
2	002023B	000231ND	000106IO	52	1.5	9.8	14.09	0	0	-	-	1.9	-	0.0	0.0	0	0	0	Sufficient Capacity
2	002137STMP	001551IN	000515SMH	48	1.5	5.22	8.7	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
2	002138STMP	000515SMH	000516SMH	24	1.5	5.22	12.05	0	0	-	0.2	-	-	0.0	0.0	0	0	0	Sufficient Capacity
2	002139STMP	000516SMH	001553IN	168	1.5	18.68	13.29	0	0	0.9	4.0	-	-	0.0	0.0	0	0	0	Surcharged
2	002141STMP	001555IN	001553IN	45	1.25	6.8	5.43	0	0	4.0	4.2	1.7	-	0.0	0.0	0	0	0	Insufficient Freeboard
2	002150STMP	001553IN	000511SMH	269	1.75	29.39	12.07	0	0	3.7	-	-	-	0.0	0.0	0	0	0	Surcharged
2	002154STMP	001561IN	001570IN	46	1.25	9.56	7.72	0.7	0.6	Flooded	2.3	Flooded	0.5	0.6	0.0	1448	0	Flooded	
2	002160STMP	001568IN	000521SMH	10	1.25	3.52	2.83	0.4	0.9	2.7	3.1	0.0	0.0	0.0	0.0	0	0	Insufficient Freeboard	
2	002162STMP	001570IN	000521SMH	20	1.25	9.53	7.73	0.6	0.9	2.3	3.1	0.5	0.0	0.0	0.0	0	0	Insufficient Freeboard	
2	002163STMP	000521SMH	000522SMH	119	1.5	10.31	5.83	0.9	0.7	2.8	2.7	0.0	-	0.0	0.0	0	0	0	Insufficient Freeboard
2	002246STMP	000117IO	000510SMH	232	2.5	49.14	12.23	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
2	002422STMP	000510SMH	000509SMH	15	3	92.95	14.43	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
2	002423STMP	001535IN	000510SMH	83	2	44.1	16.9	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
2	002424STMP	000513SMH	001535IN	173	1.5	5.87	11.95	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
2	002425STMP	001536IN	001535IN	58	1.5	34.01	19.13	0.1	0	1.6	-	-	-	0.					

TABLE 1

## Holmes Run Detailed Hydraulic Model Results

Subshed	DGravityMain FacilityID	Junction FacilityID		Length (ft)	Diameter/ Height x Width (ft)	Maximum Flow (ft³/s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft³)		Summary Pipe Condition	
		US	DS					US	DS	US	DS	US	DS	US	DS	US	DS		
2	002651STMP	000910SMH	002950IN	38	3	36.65	11.64	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002652STMP	002930IN	000918SMH	41	2.5	36.56	10.28	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002672STMP	000512SMH	000511SMH	38	1.5	4.79	7.89	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002681STMP	000514SMH	000516SMH	45	1.5	13.73	11.98	0	0	-	-	0.9	-	-	0.0	0.0	0	0	Sufficient Capacity
2	002682STMP	001544IN	000514SMH	21	1.25	8.11	8.29	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002683STMP	001546IN	000514SMH	68	1.5	5.82	4.29	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002728STMP	000916SMH	000920SMH	200	4.5	92.28	15.41	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002729STMP	000919SMH	002945IN	7	2	-21.66	6.91	0	0	0.0	-	-	-	0.0	0.0	0	0	Surcharged	
2	002730STMP	002945IN	000917SMH	54	2	28.6	12.72	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002732STMP	002939IN	002941IN	177	2.25	59.42	19.91	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002733STMP	000912SMH	000919SMH	88	2	21.67	8.99	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002734STMP	002944IN	000916SMH	79	4	92.14	21.83	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002739STMP	002950IN	000921SMH	273	3	-65.06	9.2	0	0	3.9	-	-	-	0.0	0.0	0	0	Surcharged	
2	002740STMP	000921SMH	002952IN	179	3	107.1	15.17	0	0	1.0	-	-	-	0.0	0.0	0	0	Surcharged	
2	002741STMP	002951IN	000921SMH	109	3	34.33	8	0	0	-	0.8	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002742STMP	002952IN	002953IN	177	3.5	125.92	12.62	0	0	0.4	-	-	-	0.0	0.0	0	0	Surcharged	
2	002744STMP	002953IN	002954IN	89	4	125.98	10.23	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002746STMP	002954IN	000196IO	12	4	126	10.78	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002863STMP	000643SMH	000666SMH	160	2.5	24.62	12.38	0	0.1	-	0.4	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002866STMP	000644SMH	000647SMH	226	1.75	21.5	8.91	0	0	0.9	0.7	-	-	0.0	0.0	0	0	Surcharged	
2	002868STMP	001938IN	001940IN	63	1.25	8.47	9.5	0.3	0.2	5.7	7.4	0.4	0.9	0.0	0.0	0	0	Insufficient Freeboard	
2	002870STMP	001940IN	002008IN	284	1.5	26.91	14.81	0.2	0	7.4	-	0.9	-	0.0	0.0	0	0	Insufficient Freeboard	
2	002872STMP	000642SMH	000643SMH	36	2.5	19.25	9.93	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002877STMP	000652SMH	001945IN	129	1.5	7.56	10.97	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002951STMP	001545IN	001544IN	41	1.25	4.24	8.92	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002956STMP	000522SMH	000525SMH	301	1.5	13.01	7.41	0.7	0.6	2.9	2.6	-	0.1	0.0	0	0	Surcharged		
2	002964STMP	000524SMH	000525SMH	36	1.5	-9.86	5.51	0.7	0.6	Flooded	2.6	Flooded	0.1	0.1	0.0	192	0	Flooded	
2	002965STMP	000525SMH	000526SMH	291	1.75	21.9	10.44	0.6	0.8	2.4	Flooded	0.1	Flooded	0.0	0.7	0	6842	Insufficient Freeboard	
2	002997STMP	001909IN	001905IN	4	2	19.2	16.54	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	002998STMP	001905IN	004063SMH	14	2	19.22	10.3	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003002STMP	000136IO	001909IN	34	2	-19.19	7.19	0	0	-	-	1.6	-	0.0	0.0	0	0	Sufficient Capacity	
2	003007STMP	001947IN	001945IN	57	1.25	5.83	6.98	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003008STMP	001945IN	001948IN	263	1.5	13.34	13.23	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003011STMP	001948IN	001950IN	146	2	25.38	9.1	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003012STMP	001951IN	001950IN	17	1	14.62	18.15	0.5	0	Flooded	-	Flooded	-	0.1	0.0	81	0	Flooded	
2	003013STMP	001950IN	001952IN	169	2.5	39.98	9.39	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003015STMP	001952IN	001956IN	74	3	51.52	8.6	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003016STMP	001953IN	001952IN	59	1.5	7.33	6.97	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003019STMP	001956IN	000653SMH	278	3	51.41	8.02	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003020STMP	000653SMH	000654SMH	63	2.5	51.37	10.89	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003047STMP	001977IN	000659SMH	29	3.5	108.81	15.74	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003048STMP	000659SMH	001985IN	49	3.5	119.21	18.75	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003050STMP	001979IN	000659SMH	114	1.5	10.55	17.08	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003053STMP	001982IN	000661SMH	41	3.5	119.26	15.2	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003054STMP	001985IN	001982IN	58	3.5	119.26</td													

TABLE 1

## Holmes Run Detailed Hydraulic Model Results

Subshed	DGravity	Main FacilityID	Junction FacilityID			Diameter/ Height x Width (ft)	Maximum Flow (ft³/s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft³)		Summary Pipe Condition
			US	DS	Length (ft)				US	DS	US	DS	US	DS	US	DS	US	DS	
2	003061STMP	000662SMH	001984IN	23	4	191.06	26.27	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003062STMP	000664SMH	002001IN	208	1.5	8.06	10.43	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003070STMP	001991IN	001992IN	41	1.25	7.71	15.25	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003071STMP	001992IN	000666SMH	45	1.5	7.67	8.59	0	0.1	-	1.0	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003072STMP	000666SMH	000003PD	87	2.5	51.45	10.5	0.1	0	0.7	-	-	1.6	0.0	0.0	0	0	Surcharged	
2	003073STMP	001993IN	001994IN	177	1.5	5.85	10.45	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003074STMP	001994IN	000249ND	35	1.75	-18.51	-8.2	0	55.3	-	1.5	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003075STMP	001995IN	000249ND	146	1.5	18.5	13.03	0	55.3	-	1.8	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003076STMP	001996IN	001995IN	111	1.25	18.49	19.26	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003082STMP	002001IN	000668SMH	75	1.75	32.44	13.45	0	0	0.9	-	-	-	0.0	0.0	0	0	Surcharged	
2	003083STMP	000668SMH	000140IO	32	2	32.46	21.67	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003085STMP	000669SMH	000662SMH	150	2.5	65.14	20.52	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003106STMP	000526SMH	000528SMH	77	1.5	27.43	15.27	0.8	0	Flooded	2.2	Flooded	-	0.7	0.0	6842	0	Flooded	
2	003109STMP	000527SMH	000113IO	150	1.75	29.87	13.58	0.5	0	2.8	-	-	-	0.0	0.0	0	0	Surcharged	
2	003110STMP	001585IN	000527SMH	56	1.25	4.92	10.01	0	0.5	-	1.4	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003111STMP	000528SMH	000527SMH	28	1.75	27.45	13.67	0	0.5	2.2	2.8	-	-	0.0	0.0	0	0	Surcharged	
2	003124STMP	001593IN	000531SMH	7	1.25	-8.15	6.57	0.7	0.7	Flooded	2.5	Flooded	0.2	0.1	0.0	41	0	Flooded	
2	003125STMP	000531SMH	000532SMH	295	1.25	7.95	6.45	0.7	0.3	2.5	1.3	0.2	-	0.0	0.0	0	0	Insufficient Freeboard	
2	003127STMP	001595IN	000532SMH	22	1.25	4.95	6.36	0.1	0.3	0.5	1.3	-	-	0.0	0.0	0	0	Surcharged	
2	003128STMP	000532SMH	000533SMH	44	1.25	11.67	9.72	0.3	0	1.3	1.0	-	-	0.0	0.0	0	0	Surcharged	
2	003129STMP	001596IN	001595IN	55	1.25	-5.03	4.08	0.2	0.1	1.1	0.5	1.5	-	0.0	0.0	0	0	Insufficient Freeboard	
2	003131STMP	000533SMH	000574SMH	207	1.5	11.89	8.62	0	0.3	0.7	2.1	-	-	0.0	0.0	0	0	Surcharged	
2	003209STMP	000573SMH	000002PD	15	3	81.37	14.46	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003210STMP	000574SMH	000212ND	115	1.5	19.24	10.8	0.3	0	2.1	0.5	-	-	0.0	0.0	0	0	Surcharged	
2	003364STMP	000654SMH	000669SMH	90	2.5	65.08	19.39	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003368STMP	001960IN	000655SMH	66	3	8.1	3.45	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003371STMP	000656SMH	000655SMH	59	3	95.06	18.66	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003372STMP	001961IN	000656SMH	44	3	94.93	19.84	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003373STMP	001962IN	001961IN	160	3	94.82	18.3	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003374STMP	001963IN	001962IN	164	3	83.37	17.13	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003375STMP	001964IN	001963IN	50	2	18.43	15.58	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003379STMP	000254ND	002021IN	382	3.5	48.94	17.06	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003380STMP	002022IN	002023IN	93	3	55.1	16.42	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003381STMP	002023IN	000003PD	102	3	55.21	8.33	0	0	-	-	-	1.6	0.0	0.0	0	0	Sufficient Capacity	
2	003389STMP	002029IN	000673SMH	176	1.5	19.69	10.99	0.1	0	2.6	0.4	-	-	0.0	0.0	0	0	Surcharged	
2	003390STMP	000673SMH	002030IN	120	1.5	19.54	12.71	0	0.2	1.1	1.9	-	-	0.0	0.0	0	0	Surcharged	
2	003391STMP	002030IN	000671SMH	36	1.5	19.57	10.95	0.2	0.3	2.9	1.9	-	-	0.0	0.0	0	0	Surcharged	
2	003392STMP	000671SMH	000666SMH	44	1.5	19.7	11.07	0.3	0.1	1.9	1.1	-	-	0.0	0.0	0	0	Surcharged	
2	003394STMP	004053SMH	000144IO	126	3.5	145.55	34.15	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	003395STMP	002031IN	000672SMH	143	3.5	138.86	14.95	0.2	0	2.3	-	-	-	0.0	0.0	0	0	Surcharged	
2	003396STMP	002019IN	001938IN	36	1.25	6.6	7.43	0.5	0.3	Flooded	5.4	Flooded	0.4	0.3	0.0	1434	0	Flooded	
2	003820STMP	000843SMH	002930IN	197	2.5	29	12.37	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
2	004512STMP	000911SMH	002936IN	175	1.25	7.21	8.06	0	0	-	0.4	-	1.7	0.0	0.0	0	0	Sufficient Capacity	
2	004516STMP	000913SMH	002936IN	64	1.25	14.89</td													

TABLE 1

## Holmes Run Detailed Hydraulic Model Results

Subshed	DGravityMain FacilityID	Junction FacilityID		Length (ft)	Diameter/ Height x Width (ft)	Maximum Flow (ft³/s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft³)		Summary Pipe Condition
		US	DS					US	DS	US	DS	US	DS	US	DS	US	DS	
2	004524STMP	000920SMH	000193IO	71	4.5	92.43	13.8	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
2	004527STMP	000915SMH	002942IN	213	3.5	91.74	19.63	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
2	004528STMP	002942IN	002943IN	182	3.5	91.9	19.24	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
2	004529STMP	002943IN	002944IN	72	3.5	92.04	17.93	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
2	004612STMP	002963IN	000199IO	212	3	73.31	10	0.2	0	0.5	-	-	-	0.0	0.0	0	0	Surcharged
2	004614STMP	000362ND	002963IN	105	1.5	6.74	7.08	0	0.2	-	0.3	1.3	-	0.0	0.0	0	0	Sufficient Capacity
2	004617STMP	002962IN	002963IN	167	2.25	63.93	16.51	0	0.2	1.5	0.2	-	-	0.0	0.0	0	0	Surcharged
2	004619STMP	002957IN	002960IN	66	1.75	49.12	20.6	0.5	0.5	Flooded	3.2	Flooded	-	0.5	0.0	6554	0	Flooded
2	004620STMP	002960IN	002961IN	201	2	51.98	18.93	0.5	0.7	3.4	Flooded	-	Flooded	0.0	0.6	0	10112	Surcharged
2	004621STMP	002961IN	002962IN	338	2	53.75	16.84	0.7	0	Flooded	1.2	Flooded	-	0.6	0.0	10112	0	Flooded
2	004622STMP	002956IN	002957IN	262	1.75	45.82	19.5	0.4	0.5	Flooded	Flooded	Flooded	Flooded	0.3	0.5	2154	6554	Flooded
2	005056STMP	003004IN	001010SMH	30	2.5	30.53	7.49	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
2	005057STMP	000363ND	003004IN	60	1.5	30.49	18.39	0	0	-	0.2	0.6	-	0.0	0.0	0	0	Sufficient Capacity
2	005060STMP	001011SMH	002951IN	19	2.5	35.2	14.11	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
2	005070STMP	001010SMH	001011SMH	39	2.5	35.42	8.62	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
2	005074STMP	001012SMH	000843SMH	170	2.5	29.07	18.62	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
2	005076STMP	003011IN	001012SMH	52	2	29.11	11.38	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
2	014577STMP	001994IN	002001IN	47	1.75	24.35	24.78	0	0	-	0.9	-	-	0.0	0.0	0	0	Sufficient Capacity
2	014580STMP	001975IN	001977IN	107	3.5	108.74	14.46	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
2	014581STMP	0006555MH	001975IN	57	3.5	103.1	14	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
2	014598STMP	000212ND	000573SMH	28	3	81.37	16.17	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
2	014599STMP	001621IN	000212ND	42	3	62.18	14.17	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
2	014614STMP	004063SMH	000642SMH	68	2.5	19.23	9.56	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
2	014621STMP	000672SMH	004053SMH	11	3.5	138.96	24.01	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	001106STMP	000927SMH	000928SMH	318	1.75	34.68	14.26	0.7	0	Flooded	-	Flooded	-	0.7	0.0	6065	0	Flooded
3	002548STMP	002260IN	002261IN	322	1.25	9.57	12.58	0	1.8	-	Flooded	1.1	Flooded	0.0	1.2	0	10368	Sufficient Capacity
3	002549STMP	002261IN	002262IN	54	1.25	-18.58	14.82	1.8	1.2	Flooded	4.0	Flooded	1.8	1.2	0.0	10368	0	Flooded
3	002550A	002262IN	000284ND	104	1.5	19.27	13.33	1.2	1.2	3.7	6.1	1.8	0.0	0.0	0	0	0	Insufficient Freeboard
3	002550B	000284ND	000283ND	70	1.5	19.62	12.76	1.2	1.2	6.1	Flooded	0.0	Flooded	0.0	1.0	0	44	Insufficient Freeboard
3	002550C	000283ND	002268IN	190	1.5	27.77	15.36	1.2	1.2	Flooded	Flooded	Flooded	1.0	1.1	44	4397	Flooded	
3	002551STMP	002264IN	002263IN	38	1.25	13.25	10.53	1.5	1.6	Flooded	Flooded	Flooded	1.4	1.3	10561	9428	Flooded	
3	002555STMP	002270IN	002268IN	57	1.25	6.71	5.35	1.2	1.2	Flooded	Flooded	Flooded	0.8	1.1	1339	4397	Flooded	
3	002557STMP	002271IN	002270IN	49	1.25	6.73	5.36	1.2	1.2	Flooded	Flooded	Flooded	1.2	0.8	3489	1339	Flooded	
3	002558STMP	000282ND	002271IN	77	1.25	6.57	8.29	1.1	1.2	Flooded	Flooded	Flooded	0.2	1.2	4	3489	Flooded	
3	002559STMP	002272IN	000763SMH	52	2	27.84	10.76	0.5	0.5	3.8	4.4	1.0	1.9	0.0	0	0	0	Insufficient Freeboard
3	002560STMP	002273IN	002272IN	56	1.75	-6.06	4.42	0.4	0.5	2.8	3.8	1.7	1.0	0.0	0	0	0	Insufficient Freeboard
3	002562STMP	002275IN	000763SMH	50	1.5	18.6	13.39	0.4	0.5	2.7	3.4	0.4	1.9	0.0	0	0	0	Insufficient Freeboard
3	002574STMP	000873SMH	000761SMH	200	1.5	18.26	10.13	1.2	1.2	Flooded	3.4	Flooded	0.4	1.1	0.0	18143	0	Flooded
3	002575STMP	000874SMH	000873SMH	126	1.5	19.59	11.77	0.1	1.2	0.1	Flooded	-	Flooded	0.0	1.1	0	18143	Surcharged
3	002610B	000288ND	000779SMH	222	4	117.74	15.32	0.1	0.3	0.1	3.6	-	-	0.0	0.0	0	0	Surcharged
3	002625STMP	000756SMH	000922SMH	248	1.75	34.12	16.5	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	002626STMP	000924SMH	000922SMH	114	2	33.37	13.8	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	002630STMP	000925SMH	000924SMH	279	1.75	33.37	13.69	0.7	0	Flooded	-	Flooded	-	0.4	0.0	1511	0	

TABLE 1

## Holmes Run Detailed Hydraulic Model Results

Subshed	DGravity	Main FacilityID	Junction FacilityID			Diameter/ Height x Width (ft)	Maximum Flow (ft³/s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft³)		Summary Pipe Condition
			US	DS	Length (ft)				US	DS	US	DS	US	DS	US	DS	US	DS	
3	002713STMP	000775SMH	000715SMH	70	3.5 x 4	281.57	20.21	0.3	0.4	3.0	2.6	1.0	-	0.0	0.0	0	0	0	Insufficient Freeboard
3	002715A	000716SMH	000268ND	277	4.5	304.9	18.93	0	0.7	9.6	5.0	-	-	0.0	0.0	0	0	0	Surcharged
3	002715B	000268ND	000717SMH	277	4.5	312.12	19.5	0.7	0	5.0	-	-	-	0.0	0.0	0	0	0	Surcharged
3	002718STMP	000717SMH	002124IN	215	4.5	312.12	23.35	0	0.6	-	0.4	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	002720STMP	002124IN	000149IO	59	4.5	324.9	19.58	0.6	0	0.7	-	-	1.7	0.0	0.0	0	0	0	Surcharged
3	002747STMP	002559IN	002560IN	37	1.5	14.15	7.7	0.1	0	0.4	0.1	-	-	0.0	0.0	0	0	0	Surcharged
3	002749STMP	002560IN	002829IN	75	1.5	13.8	18.71	0	0.3	0.4	10.6	-	1.9	0.0	0.0	0	0	0	Surcharged
3	002750STMP	002562IN	002828IN	76	1.75	27.23	18.1	0	0.1	1.3	4.5	-	-	0.0	0.0	0	0	0	Surcharged
3	002751STMP	002563IN	002562IN	150	1.75	17.49	15.76	0	0	-	0.6	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	002753STMP	002564IN	002563IN	39	1.5	7.3	6.96	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	002754STMP	000992SMH	002564IN	15	1.5	-7.3	4.3	0.5	0	0.4	-	-	-	0.0	0.0	0	0	0	Surcharged
3	002755STMP	000878SMH	004054SMH	8	0.667	7.3	19.15	0.7	0	10.5	0.3	-	-	0.0	0.0	0	0	0	Surcharged
3	002757STMP	002565IN	002563IN	260	1.75	10.25	10.49	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	002760STMP	000947SMH	000948SMH	81	1.5	25.36	15.22	1.2	1.2	3.2	3.4	0.3	0.9	0.0	0.0	0	0	0	Insufficient Freeboard
3	002761STMP	000948SMH	000949SMH	319	1.5	26.41	15.87	1.2	0.6	3.6	2.5	0.9	1.0	0.0	0.0	0	0	0	Insufficient Freeboard
3	002766STMP	000949SMH	000950SMH	126	2	42.19	16.43	0.6	1	2.3	Flooded	1.0	Flooded	0.0	0.9	0	7363	0	Insufficient Freeboard
3	002770STMP	000950SMH	000951SMH	373	2	34.86	10.99	1	0.9	Flooded	2.4	Flooded	1.8	0.9	0.0	7363	0	Flooded	
3	002792STMP	002737IN	002738IN	199	1.5	9.68	14.25	0	0.1	-	2.6	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	002793STMP	002738IN	002739IN	55	1.5	10.26	9.39	0.1	0.1	3.0	Flooded	-	Flooded	0.0	0.1	0	106	0	Surcharged
3	002795STMP	002739IN	002741IN	338	1.5	31.78	19.23	0.1	0.3	Flooded	Flooded	Flooded	Flooded	0.1	0.1	106	544	0	Flooded
3	002799STMP	002741IN	000988SMH	44	1.5	32.02	17.79	0.3	0.3	Flooded	3.4	Flooded	-	0.1	0.0	544	0	Flooded	
3	002800STMP	000989SMH	000768SMH	102	4	151.76	12.03	0.2	0.2	2.5	1.8	-	1.1	0.0	0.0	0	0	0	Surcharged
3	002820STMP	003307IN	003306IN	184	1.5	11.4	6.39	0.8	0.8	Flooded	1.6	Flooded	0.4	0.8	0.0	3986	0	Flooded	
3	002851STMP	000952SMH	002648IN	48	1.25	15.14	12.79	0.5	0.5	Flooded	5.5	Flooded	0.3	0.4	0.0	1564	0	Flooded	
3	002852STMP	000953SMH	000952SMH	32	1.25	5.31	7.54	0.5	0.5	4.3	Flooded	0.3	Flooded	0.0	0.4	0	1564	0	Insufficient Freeboard
3	002853STMP	002647IN	000952SMH	62	1.25	12.71	10.05	0.5	0.5	Flooded	Flooded	Flooded	Flooded	0.4	0.4	1086	1564	0	Flooded
3	002857STMP	002602IN	002649IN	225	1.5	26.92	14.89	0.7	1.1	Flooded	Flooded	Flooded	Flooded	0.5	1.0	1478	11526	0	Flooded
3	002860STMP	000954SMH	003134IN	127	1.75	7.37	10.66	0	0.2	-	2.5	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	002862STMP	003133IN	003135IN	245	4	224.65	21.6	0	0.3	1.9	Flooded	-	Flooded	0.0	0.1	0	271	0	Surcharged
3	002893STMP	000890SMH	000346ND	173	2.5	51.3	21.14	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	002911STMP	000991SMH	002658IN	195	1.5	12.91	10.29	0	0.3	-	0.5	-	1.5	0.0	0.0	0	0	0	Sufficient Capacity
3	002912STMP	000991SMH	000990SMH	110	1.5	22.3	17.66	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	002916STMP	002751IN	002752IN	128	1.5	28.15	27.31	0	0.3	-	Flooded	1.2	Flooded	0.0	0.3	0	2407	0	Sufficient Capacity
3	002917STMP	002752IN	002753IN	210	1.5	35.34	21.45	0.3	0	Flooded	-	Flooded	0.8	0.3	0.0	2407	0	Flooded	
3	002918STMP	002753IN	000991SMH	242	1.75	35.05	18.48	0	0	-	-	0.8	-	0.0	0.0	0	0	0	Sufficient Capacity
3	002921STMP	000940SMH	000939SMH	312	1.5	22.71	13.99	1.3	1.3	3.2	Flooded	1.3	Flooded	0.0	0.7	0	776	0	Insufficient Freeboard
3	002924STMP	002688IN	002689IN	49	1.25	22.85	18.23	0.3	0.2	Flooded	1.9	Flooded	0.3	0.2	0.0	442	0	Flooded	
3	002925STMP	002691IN	002688IN	40	1.25	11.9	11.5	0.2	0.3	Flooded	Flooded	Flooded	Flooded	0.2	0.2	695	442	0	Flooded
3	002927STMP	000961SMH	000962SMH	203	2	55.28	18.18	0.6	0.5	2.0	0.1	0.4	-	0.0	0.0	0	0	0	Insufficient Freeboard
3	002929STMP	000962SMH	002693IN	14	2	55.28	17.67	0.5	0	0.3	-	-	-	0.0	0.0	0	0	0	Surcharged
3	002930STMP	002693IN	000964SMH	34	2	60.57													

TABLE 1

## Holmes Run Detailed Hydraulic Model Results

Subshed	DGravityMain FacilityID	Junction FacilityID			Diameter/ Height x Width (ft)	Maximum Flow (ft³/s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft³)		Summary Pipe Condition	
		US	DS	Length (ft)				US	DS	US	DS	US	DS	US	DS	US	DS		
3	002947STMP	002662IN	002665IN	27	1.25	14.65	15.02	0.5	0.6	Flooded	4.0	Flooded	0.4	0.4	0.0	1164	0	Flooded	
3	002948STMP	002694IN	002662IN	87	1.25	12.77	15.63	0	0.5	-	Flooded	1.0	Flooded	0.0	0.4	0	1164	0	Sufficient Capacity
3	003024STMP	001057SMH	001058SMH	182	3.5	65.55	7.15	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	003027STMP	000379ND	001058SMH	130	1.5	3.42	7.04	0	0	-	-	1.6	-	0.0	0.0	0	0	0	Sufficient Capacity
3	003032STMP	003257IN	001060SMH	27	1.5	-15.33	8.61	0	0.1	1.9	1.2	0.6	0.6	0.0	0.0	0	0	0	Insufficient Freeboard
3	003034STMP	002222IN	002032IN	291	1.5	7.7	9.49	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	003096STMP	000749SMH	000681SMH	36	2.5	62.56	23.08	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	003097STMP	000680SMH	000749SMH	36	2.5	62.54	14.68	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	003102STMP	002032IN	000163IO	79	1.5	21.9	18.55	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	003103STMP	002209IN	002032IN	50	1.25	4.59	4.17	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	003501STMP	002110IN	000268ND	113	1.25	7.5	13.38	0	0.7	-	8.3	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	003509STMP	002119IN	000716SMH	303	4.5	296.07	25.51	0.4	0	1.6	9.3	-	-	0.0	0.0	0	0	0	Surcharged
3	003510STMP	000715SMH	002119IN	34	4.5	296.06	23.08	0.4	0.4	1.6	1.6	-	-	0.0	0.0	0	0	0	Surcharged
3	003547STMP	000747SMH	000160IO	42	4	203.16	15.71	0	0	0.3	-	-	1.5	0.0	0.0	0	0	0	Surcharged
3	003548STMP	000681SMH	000747SMH	90	4	195.95	14.97	0	0	0.5	-	-	-	0.0	0.0	0	0	0	Surcharged
3	003552STMP	002730IN	002729IN	201	1.25	8.7	9.94	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	003553STMP	002731IN	002730IN	49	1.25	4.47	6.69	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	003554STMP	002733IN	002734IN	200	1.25	4.1	10.67	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	003555STMP	002734IN	002737IN	178	1.5	9.68	12.61	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	003607STMP	002208IN	000164IO	59	1.5	20.65	12.82	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	003608STMP	002212IN	002208IN	310	1.5	20.65	11.5	0.7	0	Flooded	-	Flooded	-	0.7	0.0	7700	0	Flooded	
3	003700STMP	000922SMH	000923SMH	80	2.5	72.32	15.18	0	0	0.3	-	-	-	0.0	0.0	0	0	0	Surcharged
3	003702STMP	001476SMH	002971IN	124	1.75	10.26	7.78	0	0.2	0.0	1.9	-	-	0.0	0.0	0	0	0	Surcharged
3	003706STMP	003017IN	000994SMH	11	2.5	-24.86	5.04	0.3	0.3	1.9	1.5	1.4	1.0	0.0	0.0	0	0	0	Insufficient Freeboard
3	003708STMP	000994SMH	000995SMH	38	2	30.4	10.23	0.3	0.3	2.3	Flooded	1.0	Flooded	0.0	0.2	0	586	0	Insufficient Freeboard
3	003709STMP	000997SMH	003019IN	57	2.5	93.69	19.02	0.3	0.4	Flooded	Flooded	Flooded	Flooded	0.3	0.2	2509	343	Flooded	
3	003710STMP	003020IN	000997SMH	242	2.5	91.4	18.41	0.3	0.3	5.4	Flooded	0.0	Flooded	0.0	0.3	0	2509	0	Insufficient Freeboard
3	003711STMP	000999SMH	003022IN	155	2.25	75.5	19.34	0	0.3	5.5	4.7	-	-	0.0	0.0	0	0	0	Surcharged
3	003712STMP	001000SMH	000995SMH	40	2.25	51.37	13.14	0.3	0	5.5	5.3	-	-	0.0	0.0	0	0	0	Surcharged
3	003729STMP	000939SMH	000938SMH	302	1.5	23.32	13.41	1.3	0.5	Flooded	Flooded	Flooded	Flooded	0.7	0.2	776	227	Flooded	
3	003731STMP	000941SMH	000940SMH	87	1.5	23.96	14.54	1.3	1.3	2.8	3.2	1.7	1.3	0.0	0.0	0	0	0	Insufficient Freeboard
3	003735STMP	002627IN	000941SMH	86	1.5	24.69	13.83	1.3	1.3	Flooded	2.7	Flooded	1.7	1.3	0.0	26139	0	Flooded	
3	003736STMP	000943SMH	002627IN	149	1.5	31.86	17.62	0.8	1.3	Flooded	Flooded	Flooded	Flooded	0.7	1.3	14390	26139	Flooded	
3	003737STMP	002628IN	000943SMH	42	1.5	22.27	13.87	0.7	0.8	Flooded	Flooded	Flooded	Flooded	0.3	0.7	731	14390	Flooded	
3	003738STMP	000990SMH	002628IN	189	1.5	22.27	15.69	0	0.7	-	Flooded	-	Flooded	0.0	0.3	0	731	0	Sufficient Capacity
3	003740STMP	000944SMH	002630IN	57	1.25	15.48	13.03	1.3	1.6	Flooded	Flooded	Flooded	Flooded	0.8	1.2	7075	9179	Flooded	
3	003741STMP	002648IN	000944SMH	240	1.25	14.9	11.8	0.5	1.3	6.2	Flooded	0.3	Flooded	0.0	0.8	0	7075	0	Insufficient Freeboard
3	003742STMP	002630IN	000945SMH	86	1.5	14.67	8.16	1.6	1.6	Flooded	Flooded	Flooded	Flooded	1.2	1.6	9179	25322	Flooded	
3	003743STMP	000945SMH	000946SMH	183	1.75	22.15	9.05	1.6	1.6	Flooded	Flooded	Flooded	Flooded	1.6	1.3	25322	7885	Flooded	
3	003761STMP	002601IN	002602IN	36	1.5	21.47	12.54	0.7	0.7	Flooded	Flooded	Flooded	Flooded	0.7	0.5	3706	1478	Flooded	
3	003762STMP	002653IN	002601IN	176	1.5	18.31	12.42	0.7	0.7	3.7	Flooded	-	Flooded	0.0	0.7	0	3706	0	Surcharged
3																			

TABLE 1

## Holmes Run Detailed Hydraulic Model Results

Subshed	DGravityMain FacilityID	Junction FacilityID			Diameter/ Height x Width (ft)	Maximum Flow (ft³/s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft³)		Summary Pipe Condition
		US	DS	Length (ft)				US	DS	US	DS	US	DS	US	DS	US	DS	
3	003798STMP	002971IN	003017IN	264	2.5	24.93	5.6	0.2	0.3	1.6	1.6	-	1.4	0.0	0.0	0	0	Surcharged
3	003799STMP	000996SMH	000995SMH	26	3	101.79	16.9	0.3	0.3	2.1	Flooded	0.2	Flooded	0.0	0.2	0	586	Insufficient Freeboard
3	003804STMP	001004SMH	003023IN	107	2.25	52.41	15.07	0.3	0.3	Flooded	5.1	Flooded	1.3	0.3	0.0	2754	0	Flooded
3	003807STMP	002223IN	002224IN	5	0.833	4.36	7.94	1	0	Flooded	-	Flooded	1.1	1.0	0.0	3409	0	Flooded
3	003808STMP	002224IN	002225IN	39	1.25	4.36	9.76	0	0	-	-	1.1	-	0.0	0.0	0	0	Sufficient Capacity
3	003809STMP	002225IN	002226IN	70	2	30.49	9.7	0	0	0.1	-	-	0.0	0.0	0	0	0	Surcharged
3	003810STMP	002226IN	002253IN	114	2	30.52	14.32	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	003811STMP	000751SMH	000755SMH	153	1.5	15.47	10.37	0.1	0.1	1.1	1.9	-	-	0.0	0.0	0	0	Surcharged
3	003818STMP	000752SMH	000753SMH	45	4	186.66	14.7	0	0	0.1	-	-	-	0.0	0.0	0	0	Surcharged
3	003819STMP	000754SMH	000752SMH	183	4	166.25	13.79	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	003822STMP	000755SMH	000752SMH	178	1.5	20.32	11.42	0.1	0	1.9	-	-	-	0.0	0.0	0	0	Surcharged
3	003823STMP	000760SMH	002225IN	79	1.5	26.49	19.01	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	003827STMP	002236IN	000756SMH	39	1.25	4.6	7.22	0	0	-	0.2	-	-	0.0	0.0	0	0	Sufficient Capacity
3	003828STMP	000761SMH	000756SMH	47	1.5	29.58	16.52	1.2	0	3.4	-	0.4	-	0.0	0.0	0	0	Insufficient Freeboard
3	003838STMP	002237IN	000757SMH	95	2	20.51	6.53	0	0	0.1	-	-	-	0.0	0.0	0	0	Surcharged
3	003840STMP	002239IN	002237IN	49	2	16.52	6.83	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	003845STMP	000757SMH	004058SMH	124	2	20.5	7.48	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	003852STMP	000759SMH	000166IO	44	3	51.16	11.33	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	003853STMP	002252IN	000759SMH	63	2.5	51.07	10.66	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	003857STMP	002253IN	002252IN	187	2	35.39	14.32	0	0	-	0.1	-	-	0.0	0.0	0	0	Sufficient Capacity
3	003864STMP	002263IN	002261IN	24	1.25	16.3	12.91	1.6	1.8	Flooded	Flooded	Flooded	Flooded	1.3	1.2	9428	10368	Flooded
3	003867STMP	002246IN	002275IN	521	1.25	11.09	8.9	0.6	0.4	Flooded	2.9	Flooded	0.4	0.5	0.0	1328	0	Flooded
3	003869STMP	000763SMH	000769SMH	346	5	388.11	23.88	0.5	0.6	3.8	Flooded	1.9	Flooded	0.0	0.3	0	5519	Insufficient Freeboard
3	003870STMP	000764SMH	000763SMH	327	4.5	349.11	22.33	0.5	0.5	5.4	4.0	0.6	1.9	0.0	0.0	0	0	Insufficient Freeboard
3	003873STMP	002279IN	000765SMH	49	2	43.49	17.93	0.5	0.5	Flooded	7.9	Flooded	0.9	0.4	0.0	5655	0	Flooded
3	003874STMP	000766SMH	000765SMH	360	4	297.94	23.43	0.5	0.5	Flooded	5.9	Flooded	0.9	0.5	0.0	42578	0	Flooded
3	003875STMP	002280IN	000765SMH	26	2	20.34	14.61	0.5	0.5	3.3	4.7	0.4	0.9	0.0	0	0	0	Insufficient Freeboard
3	003877A	000765SMH	000281ND	41	4.5	340.12	22.34	0.5	0.5	5.4	5.4	0.9	1.5	0.0	0.0	0	0	Insufficient Freeboard
3	003877B	000281ND	000764SMH	308	4.5	343.03	22.51	0.5	0.5	5.4	4.9	1.5	0.6	0.0	0.0	0	0	Insufficient Freeboard
3	003878STMP	000767SMH	000766SMH	257	4	282.5	25.42	0.5	0.5	Flooded	Flooded	Flooded	Flooded	0.4	0.5	33239	42578	Flooded
3	003879STMP	000768SMH	000767SMH	170	4	245.88	21.9	0.2	0.5	3.2	Flooded	1.1	Flooded	0.0	0.4	0	33239	Insufficient Freeboard
3	003880STMP	002268IN	002279IN	597	1.75	28.61	11.7	1.2	0.5	Flooded	Flooded	Flooded	Flooded	1.1	0.4	4397	5655	Flooded
3	003881STMP	002243IN	002280IN	441	1.5	20.35	12.44	0.1	0.5	Flooded	3.5	Flooded	0.4	0.1	0.0	107	0	Flooded
3	003882A	000769SMH	000286ND	138	5	404.06	20.43	0.6	0.6	Flooded	4.5	Flooded	0.4	0.3	0.0	5519	0	Flooded
3	003882B	000286ND	000773SMH	35	5	410.52	20.81	0.6	0.6	4.5	3.9	0.4	0.9	0.0	0	0	0	Insufficient Freeboard
3	003887STMP	000773SMH	000774SMH	115	5	410.64	20.83	0.6	0.6	3.9	2.5	0.9	1.1	0.0	0.0	0	0	Insufficient Freeboard
3	003890STMP	000774SMH	000775SMH	16	5	-380.33	19.24	0.6	0.3	2.7	1.0	1.1	1.0	0.0	0.0	0	0	Insufficient Freeboard
3	003894STMP	002291IN	002293IN	65	1.25	11.68	9.41	0.3	0.3	2.4	1.4	1.3	-	0.0	0.0	0	0	Insufficient Freeboard
3	003895STMP	002292IN	002298IN	325	2	31.34	9.97	0.6	0	1.2	-	-	0.0	0.0	0	0	0	Surcharged
3	003896STMP	002293IN	002294IN	68	1.25	11.68	9.46	0.3	0	1.4	-	-	0.0	0.0	0	0	0	Surcharged
3	003897STMP	002290IN	002291IN	63	1.25	11.68	9.36	0.3	0.3	Flooded	2.2	Flooded	1.3	0.2	0.0	405	0	Flooded
3	003899STMP	002294IN	002295IN	62	1.25	11.68	11.09	0	0	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3																		

TABLE 1

## Holmes Run Detailed Hydraulic Model Results

Subshed	DGravityMain FacilityID	Junction FacilityID			Diameter/ Height x Width (ft)	Maximum Flow (ft³/s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft³)		Summary Pipe Condition	
		US	DS	Length (ft)				US	DS	US	DS	US	DS	US	DS	US	DS		
3	003964STMP	000959SMH	002751IN	163	1.25	14.1	11.49	0.3	0	Flooded	-	Flooded	1.2	0.3	0.0	995	0	Flooded	
3	003986STMP	003303IN	001075SMH	21	3.5	-32.1	4.81	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	003991STMP	001075SMH	003321IN	215	3.5	50.34	6.88	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	003992STMP	003304IN	001075SMH	30	1.5	18.27	18.59	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	003993STMP	001076SMH	003304IN	127	1.5	13.77	7.76	0.4	0	0.2	-	-	-	0.0	0.0	0	0	0	Surcharged
3	003994STMP	003305IN	001076SMH	154	1.5	13.78	7.7	0.8	0.4	2.1	0.2	1.3	-	0.0	0.0	0	0	0	Insufficient Freeboard
3	003995STMP	003310IN	003305IN	48	1.25	3.88	4.54	0.5	0.8	0.9	2.4	-	1.3	0.0	0.0	0	0	0	Surcharged
3	003996STMP	003306IN	003305IN	133	1.5	11.41	6.4	0.8	0.8	2.6	2.0	0.4	1.3	0.0	0.0	0	0	0	Insufficient Freeboard
3	004017STMP	003371IN	003372IN	51	1.25	-4.92	3.95	1.1	1	Flooded	2.2	Flooded	0.8	0.3	0.0	647	0	Flooded	
3	004018STMP	003372IN	001096SMH	24	1.25	5.42	6.33	1	1	2.2	2.4	0.8	1.0	0.0	0.0	0	0	0	Insufficient Freeboard
3	004019STMP	001096SMH	003373IN	418	3.5	105.79	10.92	1	0.5	2.9	1.3	1.0	-	0.0	0.0	0	0	0	Insufficient Freeboard
3	004020A	003373IN	000400ND	218	3.5	121.9	12.66	0.5	0	1.7	-	-	-	0.0	0.0	0	0	0	Surcharged
3	004020B	000400ND	001097SMH	104	3.5	121.97	13.33	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	004060STMP	002702IN	002705IN	124	1.25	14.13	12.52	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	004063STMP	002705IN	002711IN	36	1.25	14.14	14.14	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	004070STMP	002711IN	000964SMH	16	1.75	14.15	12.52	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	004074STMP	003019IN	000996SMH	63	2.5	101.91	20.62	0.4	0.3	Flooded	2.3	Flooded	0.2	0.2	0.0	343	0	Flooded	
3	004076STMP	000998SMH	003020IN	65	1.5	6.73	9.44	0.2	0.3	1.3	5.8	-	0.0	0.0	0	0	0	Surcharged	
3	004294STMP	000928SMH	000929SMH	111	2.5	34.84	7.84	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	004295STMP	000929SMH	000931SMH	125	3	34.81	8.57	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	004299STMP	000930SMH	000934SMH	263	3.5	118.62	16.5	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	004300STMP	000931SMH	000930SMH	77	3.5	111.33	18.8	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	004302STMP	000923SMH	000931SMH	185	3	72.61	14.33	0	0	-	-	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	004309STMP	002668IN	000961SMH	19	1.25	6.88	9.34	0.4	0.6	0.6	2.1	-	0.4	0.0	0.0	0	0	Surcharged	
3	004313STMP	002672IN	000961SMH	85	2	51.81	16.38	0.6	0.6	Flooded	1.8	Flooded	0.4	0.6	0.0	6100	0	Flooded	
3	004314STMP	000956SMH	002672IN	119	2	42.1	15.35	0.5	0.6	1.6	Flooded	0.6	Flooded	0.0	0.6	0	6100	0	Insufficient Freeboard
3	004316STMP	000957SMH	000956SMH	295	2	42.14	15.01	0.1	0.5	1.6	1.6	-	0.6	0.0	0	0	0	Surcharged	
3	004318STMP	000958SMH	000957SMH	216	1.5	31.39	17.43	0.7	0.1	4.6	1.8	0.3	-	0.0	0.0	0	0	0	Insufficient Freeboard
3	004321STMP	002678IN	000958SMH	53	1.5	31.39	17.46	0.7	0.7	Flooded	3.0	Flooded	0.3	0.7	0.0	5388	0	Flooded	
3	004322STMP	002679IN	002678IN	39	1.5	23.83	17.44	0.7	0.7	1.9	Flooded	1.3	Flooded	0.0	0.7	0	5388	0	Insufficient Freeboard
3	004323STMP	002680IN	002679IN	37	1.5	19.45	16.81	0.4	0.7	0.3	1.8	-	1.3	0.0	0	0	0	0	Surcharged
3	004324STMP	002681IN	002680IN	51	1.25	19.38	15.53	0.8	0.4	Flooded	0.5	Flooded	-	0.8	0.0	13452	0	Flooded	
3	004325STMP	002689IN	000960SMH	76	1.25	22.78	18.74	0.2	0	1.9	-	0.3	-	0.0	0.0	0	0	0	Insufficient Freeboard
3	004335STMP	000965SMH	002695IN	211	1.25	15.14	20.53	0	0.7	-	3.0	-	1.2	0.0	0.0	0	0	0	Sufficient Capacity
3	004427STMP	002717IN	002718IN	45	1.5	11.36	6.27	0.3	0.3	6.3	5.9	0.4	1.1	0.0	0.0	0	0	0	Insufficient Freeboard
3	004428STMP	002721IN	002717IN	49	1.25	11.37	11.77	0.2	0.3	4.9	6.3	0.5	0.4	0.0	0.0	0	0	0	Insufficient Freeboard
3	004429STMP	002718IN	000327ND	54	1.5	11.61	6.42	0.3	0.3	6.2	6.6	1.1	-	0.0	0.0	0	0	0	Insufficient Freeboard
3	004431STMP	000985SMH	000984SMH	44	3	99.89	19.52	0.2	0.2	3.9	5.4	0.8	1.2	0.0	0.0	0	0	0	Insufficient Freeboard
3	004433STMP	002723IN	000985SMH	58	3	99.99	21.82	0.1	0.2	1.9	3.6	-	0.8	0.0	0.0	0	0	0	Surcharged
3	004437A	002726IN	000329ND	251	3	195.39	20.15	0	0.1	-	2.2	-	-	0.0	0.0	0	0	0	Sufficient Capacity
3	004437B	000329ND	002723IN	11	3	201.51	16.53	0.1	0.1	2.2	1.9	-	-	0.0	0.0	0	0	0	Surcharged
3	004438ST																		

TABLE 1

## Holmes Run Detailed Hydraulic Model Results

Subshed	DGravityMain FacilityID	Junction FacilityID			Diameter/ Height x Width (ft)	Maximum Flow (ft³/s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft³)		Summary Pipe Condition
		US	DS	Length (ft)				US	DS	US	DS	US	DS	US	DS	US	DS	
3	004535STMP	002829IN	000890SMH	179	1.5	40.46	22.15	0.3	0	12.0	-	1.9	-	0.0	0.0	0	0	Insufficient Freeboard
3	004554STMP	002842IN	000883SMH	135	1.25	15.63	15.76	0	0.1	0.5	3.1	-	-	0.0	0.0	0	0	Surcharged
3	004555STMP	000883SMH	002732IN	233	1.25	15.46	12.42	0.1	0	3.2	-	-	-	0.0	0.0	0	0	Surcharged
3	004626STMP	002967IN	002971IN	90	1.5	14.95	8.89	0.1	0.2	1.8	1.6	-	-	0.0	0.0	0	0	Surcharged
3	004637STMP	002981IN	000999SMH	58	1.25	31.91	25.46	1	0	Flooded	6.5	Flooded	-	0.9	0.0	7436	0	Flooded
3	004643STMP	002992IN	002983IN	211	1.5	0	0	0	0.3	-	Flooded	-	Flooded	0.0	0.1	0	396	Sufficient Capacity
3	004644STMP	002983IN	001004SMH	38	2	26.57	10.96	0.3	0.3	Flooded	Flooded	Flooded	Flooded	0.1	0.3	396	2754	Flooded
3	004698STMP	001094SMH	001057SMH	317	1.5	14.36	8.05	0.4	0	3.3	-	1.4	-	0.0	0.0	0	0	Insufficient Freeboard
3	004705STMP	003364IN	001096SMH	138	3	105.11	14.73	1.1	1	Flooded	3.3	Flooded	1.0	1.0	0.0	23069	0	Flooded
3	004706STMP	003367IN	003364IN	228	3	102.69	15.19	1	1.1	Flooded	Flooded	Flooded	Flooded	0.9	1.0	28496	23069	Flooded
3	004707STMP	003365IN	003364IN	66	1.25	7.47	9.42	1	1.1	1.9	Flooded	1.0	Flooded	0.0	1.0	0	23069	Insufficient Freeboard
3	004708STMP	003366IN	003367IN	28	1.5	27.14	15.21	1	1	Flooded	Flooded	Flooded	Flooded	0.9	0.9	15596	28496	Flooded
3	004709STMP	000399ND	003366IN	118	1.5	15.99	9.57	0.5	1	Flooded	Flooded	Flooded	Flooded	0.2	0.9	17	15596	Flooded
3	004710STMP	003368IN	003367IN	153	3	112.65	15.79	0.8	1	Flooded	Flooded	Flooded	Flooded	0.6	0.9	25143	28496	Flooded
3	004711STMP	000995SMH	003368IN	327	3	125.71	18.97	0.3	0.8	Flooded	Flooded	Flooded	Flooded	0.2	0.6	586	25143	Flooded
3	004932STMP	001045SMH	001046SMH	73	4.5	250.71	18.76	0.4	0.5	4.1	4.7	0.2	1.4	0.0	0.0	0	0	Insufficient Freeboard
3	004933STMP	001046SMH	003206IN	93	4.5	250.86	15.67	0.5	0.5	4.9	4.6	1.4	0.4	0.0	0.0	0	0	Insufficient Freeboard
3	004938STMP	003202IN	001050SMH	123	3	79.25	11.15	0.4	0.4	Flooded	2.9	Flooded	0.1	0.3	0.0	263	0	Flooded
3	004939STMP	001048SMH	003202IN	158	2.5	73.59	14.88	0.6	0.4	Flooded	Flooded	Flooded	Flooded	0.4	0.3	2385	263	Flooded
3	004990STMP	003282IN	001069SMH	97	2	10.12	3.48	0.7	0.7	2.8	Flooded	0.0	Flooded	0.0	0.2	0	389	Insufficient Freeboard
3	005001STMP	001071SMH	001072SMH	69	2.5	16	6.08	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005002STMP	001072SMH	003292IN	139	2.5	16.03	7.81	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005035STMP	004535IN	000572ND	45	1.25	7.47	15.12	0	0.1	-	4.9	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005036STMP	004549IN	000571ND	26	1.25	6.92	9.09	0.2	0.2	Flooded	5.4	Flooded	0.1	0.1	0.0	245	0	Flooded
3	005053STMP	002999IN	003134IN	51	3.5	21.07	10.16	0	0.2	0.0	1.3	-	-	0.0	0.0	0	0	Surcharged
3	005055STMP	003002IN	003001IN	14	1	5.99	11.9	0	0	-	-	0.9	-	0.0	0.0	0	0	Sufficient Capacity
3	005061STMP	001006SMH	001007SMH	109	3.5	191.09	19.77	0.3	0.2	2.7	1.4	-	-	0.0	0.0	0	0	Surcharged
3	005062STMP	001005SMH	001006SMH	30	3.5	-191.1	19.73	0.5	0.3	3.8	2.4	-	-	0.0	0.0	0	0	Surcharged
3	005063STMP	001008SMH	001005SMH	309	3.5	181.32	25.52	0	0.5	-	3.5	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005064STMP	003001IN	001008SMH	10	1.25	5.99	13.64	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005065STMP	001009SMH	001008SMH	253	3.5	169.6	22.94	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005104STMP	003321IN	000209IO	99	3.5	-59.84	7.19	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005135STMP	001039SMH	003133IN	155	1.25	5.66	10.41	0	0	-	0.9	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005136STMP	003134IN	003133IN	106	3.5	219.06	22.53	0.2	0	3.8	0.7	-	-	0.0	0.0	0	0	Surcharged
3	005137STMP	001007SMH	003134IN	27	3.5	191.03	20.71	0.2	0.2	1.7	1.6	-	-	0.0	0.0	0	0	Surcharged
3	005138STMP	003135IN	003136IN	268	4	222.03	20.87	0.3	0.4	Flooded	Flooded	Flooded	Flooded	0.1	0.2	271	1996	Flooded
3	005139STMP	003136IN	003172IN	144	3.5	217.83	22.45	0.4	0.3	Flooded	Flooded	Flooded	Flooded	0.2	0.3	1996	5245	Flooded
3	005141STMP	003138IN	003139IN	138	1.25	5.38	5.67	0	0	-	-	1.9	-	0.0	0.0	0	0	Sufficient Capacity
3	005142STMP	003139IN	003181IN	249	1.25	5.37	8.65	0	0	-	-	-	1.7	0.0	0.0	0	0	Sufficient Capacity
3	005150STMP	003147IN	003149IN	264	1.5	20.27	11.32	0.2	0.6	3.1	Flooded	1.6	Flooded	0.0	0.5	0	1612	Insufficient Freeboard
3	005152STMP	003149IN	003167IN	66	1.75	24.57	10.12	0.6	0.6	Flooded	Flooded	Flooded	Flooded	0.5	0.5	1612	2981	Flooded
3	005155STMP	003152IN	003167IN	86	2	19.74	6.22	0.6	0.6	Flooded	Flooded	Flooded	Flooded	0.5	0.5	4189	2981	

TABLE 1

## Holmes Run Detailed Hydraulic Model Results

Subshed	DGravityMain FacilityID	Junction FacilityID			Diameter/ Height x Width (ft)	Maximum Flow (ft³/s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft³)		Summary Pipe Condition
		US	DS	Length (ft)				US	DS	US	DS	US	DS	US	DS	US	DS	
3	005174STMP	003168IN	003169IN	77	2.5	50.33	10.27	0.5	0	0.7	-	-	-	0.0	0.0	0	0	Surcharged
3	005175STMP	003169IN	001049SMH	175	2.5	55.42	15.52	0	0.3	-	1.4	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005177STMP	003171IN	003183IN	294	4	232.94	20.17	0.3	0.4	3.4	Flooded	0.9	Flooded	0.0	0.3	0	1271	Insufficient Freeboard
3	005178STMP	003172IN	003171IN	35	3.5	212.92	21.99	0.3	0.3	Flooded	3.1	Flooded	0.9	0.3	0.0	5245	0	Flooded
3	005187STMP	003181IN	003168IN	142	1.5	16.22	11.22	0	0.5	-	0.5	1.7	-	0.0	0.0	0	0	Sufficient Capacity
3	005188STMP	003182IN	003183IN	129	1.5	11.96	8.76	0.3	0.4	Flooded	Flooded	Flooded	Flooded	0.0	0.3	2	1271	Flooded
3	005189STMP	003183IN	003185IN	335	4	244.51	22.62	0.4	0.4	Flooded	4.0	Flooded	0.0	0.3	0.0	1271	0	Flooded
3	005190STMP	003205IN	003183IN	138	1.25	5.26	5.9	0.3	0.4	2.3	Flooded	0.3	Flooded	0.0	0.3	0	1271	Insufficient Freeboard
3	005191STMP	003185IN	001045SMH	237	4.5	250.78	15.95	0.4	0.4	4.5	3.8	0.0	0.2	0.0	0.0	0	0	Insufficient Freeboard
3	005192STMP	003189IN	003185IN	129	1.5	20.59	11.51	0.6	0.4	Flooded	5.0	Flooded	0.0	0.5	0.0	6097	0	Flooded
3	005200STMP	001043SMH	001044SMH	229	2	32.73	11.35	1	1.5	4.0	Flooded	0.2	Flooded	0.0	1.0	0	6280	Insufficient Freeboard
3	005203STMP	000951SMH	001043SMH	207	2.5	34.39	9.23	0.9	1	2.1	3.0	1.8	0.2	0.0	0	0	0	Insufficient Freeboard
3	005204STMP	001047SMH	001048SMH	264	2.5	66.54	13.44	0.6	0.6	4.8	Flooded	-	Flooded	0.0	0.4	0	2385	Surcharged
3	005205STMP	001049SMH	001047SMH	287	2.5	60.44	15.47	0.3	0.6	1.4	4.1	-	-	0.0	0.0	0	0	Surcharged
3	005206STMP	003221IN	001047SMH	127	1.75	27.24	11.21	0.5	0.6	Flooded	4.1	Flooded	-	0.5	0.0	4348	0	Flooded
3	005207STMP	003206IN	003207IN	180	4.5	318.72	19.9	0.5	0.5	5.1	3.9	0.4	0.6	0.0	0.0	0	0	Insufficient Freeboard
3	005208STMP	001050SMH	003206IN	36	3	80.05	11.29	0.4	0.5	3.9	3.8	0.1	0.4	0.0	0.0	0	0	Insufficient Freeboard
3	005209STMP	003207IN	003215IN	258	5	318.79	16.16	0.5	0.5	3.9	Flooded	0.6	Flooded	0.0	0.4	0	1932	Insufficient Freeboard
3	005216STMP	003215IN	003214IN	160	5	319.18	16.21	0.5	0.5	Flooded	1.4	Flooded	0.4	0.4	0.0	1932	0	Flooded
3	005220STMP	003219IN	003221IN	65	1.25	10.99	8.89	0.7	0.5	3.5	Flooded	0.8	Flooded	0.0	0.5	0	4348	Insufficient Freeboard
3	005221STMP	003229IN	003219IN	153	1.25	9.92	8.04	0.7	0.7	Flooded	3.3	Flooded	0.8	0.7	0.0	3561	0	Flooded
3	005233STMP	003234IN	001051SMH	49	1.75	8.54	6.44	0	0	-	0.5	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005236STMP	001051SMH	001052SMH	69	2.5	31.13	6.62	0	0	0.1	0.2	-	-	0.0	0.0	0	0	Surcharged
3	005239STMP	001052SMH	001054SMH	265	2.5	37.27	7.61	0	0	0.2	-	-	-	0.0	0.0	0	0	Surcharged
3	005252STMP	001054SMH	001055SMH	85	3	45.37	7.92	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005253STMP	001055SMH	001057SMH	166	3	51.25	8.07	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005257STMP	001060SMH	001061SMH	43	1.5	15.35	10.6	0.1	0.1	1.2	1.4	0.6	1.1	0.0	0.0	0	0	Insufficient Freeboard
3	005258STMP	001061SMH	001051SMH	340	2	23.2	7.33	0.1	0	1.7	0.3	1.1	-	0.0	0.0	0	0	Insufficient Freeboard
3	005271STMP	001063SMH	000206IO	137	2.5	50.71	11.27	0	0	-	-	-	0.6	0.0	0.0	0	0	Sufficient Capacity
3	005272STMP	001064SMH	001063SMH	92	2.5	37.81	8.18	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005273STMP	001065SMH	001064SMH	194	2.5	37.8	7.95	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005276STMP	001067SMH	001065SMH	255	2	27.53	8.71	0.4	0	2.0	0.3	1.5	-	0.0	0.0	0	0	Insufficient Freeboard
3	005280STMP	001069SMH	001067SMH	200	2	27.51	8.66	0.7	0.4	Flooded	1.8	Flooded	1.5	0.2	0.0	389	0	Flooded
3	005285STMP	001068SMH	001069SMH	59	1.5	23.42	13.04	0.8	0.7	Flooded	Flooded	Flooded	Flooded	0.7	0.2	5901	389	Flooded
3	005290STMP	003292IN	001074SMH	136	3	16.1	4.06	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005293STMP	001074SMH	001073SMH	62	3	32.07	6.25	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005296STMP	001073SMH	003303IN	184	3.5	32.07	7.17	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005299STMP	001092SMH	001054SMH	252	1.5	8.19	4.67	0	0	0.1	-	-	-	0.0	0.0	0	0	Surcharged
3	005839STMP	001216SMH	001217SMH	50	3.5	79.2	8.45	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005840STMP	001058SMH	001216SMH	83	3.5	68.76	7.13	0	0	0.1	-	-	-	0.0	0.0	0	0	Surcharged
3	005846STMP	001217SMH	000261IO	189	3.5	79.25	8.51	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005851STMP	003214IN	003901IN	264	5	331.7	16.89	0.5	0	1.6	-	0.4	-	0.0	0.0	0	0	Insufficient Freeboard
3	005855STMP</																	

TABLE 1

## Holmes Run Detailed Hydraulic Model Results

Subshed	DGravityMain FacilityID	Junction FacilityID			Diameter/ Height x Width (ft)	Maximum Flow (ft³/s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft³)		Summary Pipe Condition
		US	DS	Length (ft)				US	DS	US	DS	US	DS	US	DS	US	DS	
3	005865STMP	001219SMH	001220SMH	75	2.39	40.85	8.99	1.6	1.5	Flooded	Flooded	Flooded	Flooded	1.3	1.5	7506	6159	Flooded
3	005866STMP	001220SMH	001221SMH	23	2.39	38.83	8.58	1.5	1.5	Flooded	Flooded	Flooded	Flooded	1.5	1.3	6159	3560	Flooded
3	005867STMP	001221SMH	001222SMH	98	2.39	37.91	8.38	1.5	1.5	Flooded	1.3	Flooded	0.2	1.3	0.0	3560	0	Flooded
3	005873STMP	001222SMH	000266IO	182	2.39	37.9	8.48	1.5	0	1.5	-	0.2	0.9	0.0	0.0	0	0	Insufficient Freeboard
3	005875STMP	003813IN	000268IO	215	4.5	206.41	18.4	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005876STMP	003846IN	009064IN	61	4.5	195.06	16.39	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005933STMP	000753SMH	001248SMH	135	4.5	190.26	13.61	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005934STMP	001248SMH	003846IN	110	4.5	194.98	13.88	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	005935STMP	003844IN	001248SMH	57	1.25	4.88	5.45	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	006348STMP	004538IN	004536IN	36	1.5	25.08	18.24	0.1	0.3	1.9	4.3	1.4	1.9	0.0	0.0	0	0	Insufficient Freeboard
3	006351STMP	001456SMH	001457SMH	30	1.5	14.64	15	0	0.1	-	1.6	-	-	0.0	0.0	0	0	Sufficient Capacity
3	006355STMP	001458SMH	001459SMH	220	3	116.35	17.25	0.3	0.4	Flooded	Flooded	Flooded	Flooded	0.1	0.3	33	6342	Flooded
3	006356STMP	004557IN	001458SMH	10	1.5	36.1	20.2	0.3	0.3	Flooded	Flooded	Flooded	Flooded	0.3	0.1	5217	33	Flooded
3	006357STMP	001457SMH	001458SMH	244	2.5	76.61	19.69	0.1	0.3	1.2	Flooded	-	Flooded	0.0	0.1	0	33	Surcharged
3	006358STMP	001459SMH	001460SMH	86	3	121.47	22.12	0.4	0.4	Flooded	Flooded	Flooded	Flooded	0.3	0.2	6342	850	Flooded
3	006359STMP	001460SMH	001461SMH	108	3.5	120.2	12.31	0.4	0.4	Flooded	Flooded	Flooded	Flooded	0.2	0.3	850	570	Flooded
3	006360A	001461SMH	000579ND	140	3.5	131.51	13.47	0.4	0.4	Flooded	7.3	Flooded	0.9	0.3	0.0	570	0	Flooded
3	006360B	000579ND	001479SMH	311	3.5	146.2	15.01	0.4	0.4	7.3	4.4	0.9	-	0.0	0.0	0	0	Insufficient Freeboard
3	006363A	001454SMH	000571ND	111	2	48.83	16.14	0.2	0.2	5.0	4.8	0.5	0.1	0.0	0	0	0	Insufficient Freeboard
3	006363B	000571ND	000570ND	65	2	62.55	19.64	0.2	0.1	4.8	3.1	0.1	1.2	0.0	0.0	0	0	Insufficient Freeboard
3	006363C	000570ND	001457SMH	58	2	62.5	19.74	0.1	0.1	3.1	1.4	1.2	-	0.0	0.0	0	0	Insufficient Freeboard
3	006364STMP	004584IN	004573IN	60	1.25	6.45	9.82	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	006382STMP	004573IN	004538IN	267	1.25	13.38	16.27	0	0.1	-	2.2	-	1.4	0.0	0.0	0	0	Sufficient Capacity
3	006383STMP	004587IN	002751IN	119	1.25	10.84	16.97	0	0	-	-	-	1.2	0.0	0.0	0	0	Sufficient Capacity
3	006384STMP	004574IN	004573IN	39	1.5	6.96	11.93	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	006436STMP	000323IO	004557IN	83	1.5	34.47	27.94	0	0.3	-	Flooded	-	Flooded	0.0	0.3	0	5217	Sufficient Capacity
3	006442STMP	000316IO	004564IN	15	1.25	27.62	22.25	0.7	0.4	Flooded	Flooded	Flooded	Flooded	0.7	0.2	15578	414	Flooded
3	006652STMP	004564IN	000579ND	11	1.25	28.2	26.42	0.4	0.4	Flooded	9.5	Flooded	0.9	0.2	0.0	414	0	Flooded
3	006653STMP	004567IN	001479SMH	34	1.25	3.73	12.89	0	0.4	-	2.3	-	-	0.0	0.0	0	0	Sufficient Capacity
3	006654A	001480SMH	000568ND	52	3.5	163.73	16.93	0.4	0.4	2.9	2.2	-	-	0.0	0.0	0	0	Surcharged
3	006654B	000568ND	001009SMH	143	3.5	163.75	16.96	0.4	0	2.2	-	-	-	0.0	0.0	0	0	Surcharged
3	006667STMP	001479SMH	001480SMH	150	3.5	152.42	15.71	0.4	0.4	4.8	2.6	-	-	0.0	0.0	0	0	Surcharged
3	006669STMP	004534IN	001453SMH	38	1.75	35.24	19.98	0.1	0.1	2.5	3.6	-	-	0.0	0.0	0	0	Surcharged
3	006670STMP	004536IN	004534IN	36	1.5	30.52	17.01	0.3	0.1	4.3	2.8	1.9	-	0.0	0.0	0	0	Insufficient Freeboard
3	006671STMP	004539IN	004538IN	47	1.25	13.95	11.22	0.3	0.1	Flooded	2.1	Flooded	1.4	0.1	0.0	266	0	Flooded
3	014575STMP	000498ND	000277IO	25	5	-82.34	7.48	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	014576STMP	001251SMH	000498ND	94	4.5	-82.33	6.6	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	014579STMP	000334ND	000768SMH	136	4	90.84	17.37	0	0.2	-	1.2	-	1.1	0.0	0.0	0	0	Sufficient Capacity
3	014584STMP	001097SMH	000402ND	28	3.5	122.01	18.42	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	014593STMP	000572ND	001454SMH	104	2	42.18	15.52	0.1	0.2	4.1	4.5	-	0.5	0.0	0.0	0	0	Surcharged
3	014594STMP	001453SMH	000572ND	25	2	34.79	13.55	0.1	0.1	3.9	4.1	-	-	0.0	0.0	0	0	Surcharged
3	014600STMP	000964SMH	000334ND	312	2.5	74.74	16.18	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	014605STMP	000984SMH																

TABLE 1

## Holmes Run Detailed Hydraulic Model Results

Subshed	DGravityMain FacilityID	Junction FacilityID			Diameter/ Height x Width (ft)	Maximum Flow (ft³/s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft³)		Summary Pipe Condition
		US	DS	Length (ft)				US	DS	US	DS	US	DS	US	DS	US	DS	
3	014615STMP	000774SMH	009080IN	163	2	32.19	10.14	0.6	0.6	3.9	1.7	1.1	-	0.0	0.0	0	0	Insufficient Freeboard
3	014616STMP	009080IN	002292IN	147	2	32	10.2	0.6	0.6	1.7	1.2	-	-	0.0	0.0	0	0	Surcharged
3	014619STMP	004058SMH	000760SMH	73	1.5	20.49	17.91	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	014620STMP	009064IN	003813IN	144	4.5	195.39	16.06	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
3	014629STMP	004054SMH	000992SMH	13	1.75	7.3	4.97	0	0.5	-	0.2	-	-	0.0	0.0	0	0	Sufficient Capacity
3	014978STMP	000346ND	009929IN	189	2.5	51.33	18.88	0	0.2	-	Flooded	-	Flooded	0.0	0.1	0	527	Sufficient Capacity
3	014979STMP	009929IN	002746IN	72	2.5	135.77	27.47	0.2	0	Flooded	-	Flooded	-	0.1	0.0	527	0	Flooded
3	014987STMP	000960SMH	002681IN	181	1.5	22.77	14.64	0	0.8	0.1	Flooded	-	Flooded	0.0	0.8	0	13452	Surcharged
3	014988STMP	000402ND	000576IO	54	3.5	122.03	30.89	0	0	-	-	-	-	2.0	0.0	0	0	Sufficient Capacity
4	002922STMP	003877IN	003820IN	78	1.75	17.45	16.46	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	002923STMP	003880IN	003877IN	302	1.5	17.45	10.79	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	003559STMP	001081SMH	001083SMH	43	1.5	23.93	13.21	6.2	6.2	Flooded	Flooded	Flooded	Flooded	5.6	6.1	2739	7087	Flooded
4	003560STMP	001082SMH	001081SMH	108	1.25	20.86	16.55	6.1	6.2	Flooded	Flooded	Flooded	Flooded	5.9	5.6	18546	2739	Flooded
4	003561STMP	003331IN	001082SMH	108	1.25	22.69	17.79	5.9	6.1	Flooded	Flooded	Flooded	Flooded	5.9	5.9	197263	18546	Flooded
4	003566STMP	001083SMH	001084SMH	127	1.25	20.85	16.56	6.2	0	Flooded	-	Flooded	-	6.1	0.0	7087	0	Flooded
4	003567STMP	001084SMH	001085SMH	61	3	30	17.55	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	003724STMP	003939IN	001251SMH	322	1.5	9.27	6.98	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	003727STMP	003936IN	002037ND	126	1.5	17.48	9.78	0.2	0	2.9	1.8	0.9	-	0.0	0.0	0	0	Insufficient Freeboard
4	003990STMP	001085SMH	000207IO	194	3	34.21	22.09	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	004047STMP	003875IN	001251SMH	247	4.5	-73	5.36	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	004057STMP	001254SMH	003876IN	74	1.25	19.1	17.47	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	004058STMP	003876IN	003878IN	114	1.5	19.11	15.15	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	004132STMP	003878IN	001255SMH	204	2	19.26	8.3	0	0.1	-	1.0	-	-	0.0	0.0	0	0	Sufficient Capacity
4	004133STMP	003855IN	001259SMH	127	3	143.3	20.1	0.3	0	4.5	-	-	-	0.0	0.0	0	0	Surcharged
4	004145STMP	003935IN	003936IN	139	1.5	17.49	9.86	0.1	0.2	2.9	2.6	-	0.9	0.0	0.0	0	0	Surcharged
4	004421STMP	001326SMH	001371SMH	354	2.5	34.65	12.2	0	0.3	-	Flooded	-	Flooded	0.0	0.2	0	1426	Sufficient Capacity
4	004659STMP	004280IN	004281IN	246	1.5	21.16	11.33	0.5	0.5	15.9	14.1	0.0	1.3	0.0	0.0	0	0	Insufficient Freeboard
4	004661STMP	001360SMH	004280IN	24	1.25	14.7	11.15	0.5	0.5	Flooded	16.1	Flooded	0.0	0.4	0.0	4939	0	Flooded
4	004662STMP	004281IN	001327SMH	268	1.5	32.81	17.57	0.5	1.3	14.1	Flooded	1.3	Flooded	0.0	1.3	0	33340	Insufficient Freeboard
4	004664STMP	000528ND	001273SMH	313	3	117.86	16.89	0.4	0	2.9	-	-	-	0.0	0.0	0	0	Surcharged
4	004665STMP	004284IN	004247IN	189	1.25	20.1	16.04	0.1	0	Flooded	0.1	Flooded	-	0.1	0.0	209	0	Flooded
4	004761STMP	001346SMH	004255IN	144	1.5	17.48	9.73	0.9	1	6.0	Flooded	0.5	Flooded	0.0	0.8	0	6794	Insufficient Freeboard
4	004823STMP	001080SMH	001084SMH	84	2.5	9.5	12.38	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	004831STMP	001087SMH	001088SMH	100	1.75	10.81	10.99	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	004832STMP	001088SMH	003340IN	23	6	238.19	22.3	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	004833STMP	001089SMH	001088SMH	95	5	227.6	19.13	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	004834STMP	003340IN	000211IO	59	4.5 x 7.667	243.83	9.95	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	004835STMP	003342IN	003341IN	38	1.5	5.24	7.17	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	004865STMP	003817IN	001224SMH	160	2.5	31.47	12.02	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	004866STMP	001223SMH	003817IN	179	2.25	31.44	12.82	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	004867STMP	003818IN	003820IN	39	1.25	3.99	3.81	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	004869STMP	003820IN	003821IN	84	2	21.42	13.91	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	004870STMP	003821IN	003822IN	49	2	21.43	11.78	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity
4	004871STMP	00382																

TABLE 1

## Holmes Run Detailed Hydraulic Model Results

Subshed	DGravity	Main FacilityID	Junction FacilityID			Diameter/ Height x Width (ft)	Maximum Flow (ft³/s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft³)		Summary Pipe Condition
			US	DS	Length (ft)				US	DS	US	DS	US	DS	US	DS	US	DS	
4	004881STMP	000551ND	004251IN	52	1	6.55	11.92	0	0.6	-	Flooded	0.6	Flooded	0.0	0.5	0	7480	Sufficient Capacity	
4	004883STMP	004253IN	001344SMH	11	1.25	9.34	12	0	0.2	-	1.1	0.9	1.7	0.0	0.0	0	0	Sufficient Capacity	
4	004884STMP	004254IN	001344SMH	253	1.5	22.84	13.53	0.9	0.2	1.8	1.2	0.7	1.7	0.0	0.0	0	0	Insufficient Freeboard	
4	004885STMP	004255IN	004254IN	61	1.5	23.99	13.38	1	0.9	Flooded	1.8	Flooded	0.7	0.8	0.0	6794	0	Flooded	
4	004886STMP	000280IO	001346SMH	139	1.5	17.37	11.18	0.9	0.9	Flooded	2.5	Flooded	0.5	0.9	0.0	13327	0	Flooded	
4	004972STMP	001243SMH	001242SMH	128	1.5	25.03	14.24	1.3	0	3.9	-	-	-	0.0	0.0	0	0	Surcharged	
4	004975STMP	003924IN	003925IN	80	1.5	12.5	8.58	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	004976STMP	003925IN	001244SMH	110	1.5	12.51	9.88	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	004979STMP	001272SMH	001245SMH	68	2	18.26	13.51	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005110STMP	003341IN	003340IN	60	1.5	5.25	7.22	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005113STMP	001090SMH	001089SMH	216	5	216.77	17.65	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005402STMP	000552ND	001389SMH	54	1.25	5.25	13.46	0	0.3	-	3.4	1.4	-	0.0	0.0	0	0	Sufficient Capacity	
4	005403STMP	000553ND	001389SMH	46	1.25	6.51	15.43	0	0.3	-	3.7	1.4	-	0.0	0.0	0	0	Sufficient Capacity	
4	005404STMP	004249IN	004327IN	294	1.25	11.43	10.22	0.1	0.3	2.8	4.1	-	1.3	0.0	0.0	0	0	Surcharged	
4	005880STMP	000484ND	001226SMH	88	2	8.61	10.48	0	0	-	-	1.9	-	0.0	0.0	0	0	Sufficient Capacity	
4	005887STMP	003831IN	001232SMH	132	4.5	23.77	9.82	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005889A	001228SMH	000487ND	99	4	154.16	24.95	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005889B	000487ND	001232SMH	23	4	154.15	22.99	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005890STMP	001229SMH	001228SMH	29	4	154.15	29.07	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005891STMP	001230SMH	001229SMH	36	4	154.13	41.31	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005892STMP	001231SMH	001230SMH	103	4	145.59	15.45	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005893STMP	001245SMH	001231SMH	134	4	145.53	26.57	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005896A	001232SMH	000488ND	21	4.5	177.84	17.53	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005896B	000488ND	001233SMH	151	4.5	178.29	18.44	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005897STMP	001233SMH	003906IN	32	4.5	178.32	23.49	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005900STMP	003906IN	001234SMH	117	4.5	178.69	24.33	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005901STMP	001234SMH	003908IN	147	4.5	196.11	25.69	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005902STMP	003908IN	001090SMH	69	5	204.77	16.66	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005903STMP	003909IN	003908IN	40	1.25	8.6	9.54	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005905STMP	003911IN	001090SMH	17	1.25	11.92	14.92	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005910STMP	003913IN	003914IN	42	2.5	56.75	15.19	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005912STMP	001236SMH	003913IN	199	2.25	56.67	22.04	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005913STMP	003914IN	001249SMH	32	2.5	87.01	20.31	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005915STMP	001239SMH	001237SMH	55	1.75	30.37	17.35	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005916STMP	001237SMH	003914IN	235	1.75	30.33	18.44	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005917STMP	001244SMH	001238SMH	196	2.25	56.55	21.14	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005919STMP	003917IN	001239SMH	96	1.5	30.33	17.02	0.1	0	2.2	-	0.1	-	0.0	0.0	0	0	Insufficient Freeboard	
4	005921STMP	003918IN	001244SMH	78	1.25	4.45	3.89	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005922STMP	003919IN	001244SMH	113	2.5	39.68	18.16	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005923STMP	001241SMH	003919IN	268	2.5	25.03	12.78	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005925STMP	001242SMH	001241SMH	65	2.5	25.03	11.82	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005928STMP	003840IN	001273SMH	21	1.5	-9.59	6.21	0	0	0.2	-	-	-	0.0	0.0	0	0	Surcharged	
4	005929STMP	001246SMH	003840IN	38	1.5	5.26	6.23	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005931STMP	003842IN	001246SMH	21	1.5	5.26	8.48	0	0	-	-	-	-	0.0	0.0				

TABLE 1

## Holmes Run Detailed Hydraulic Model Results

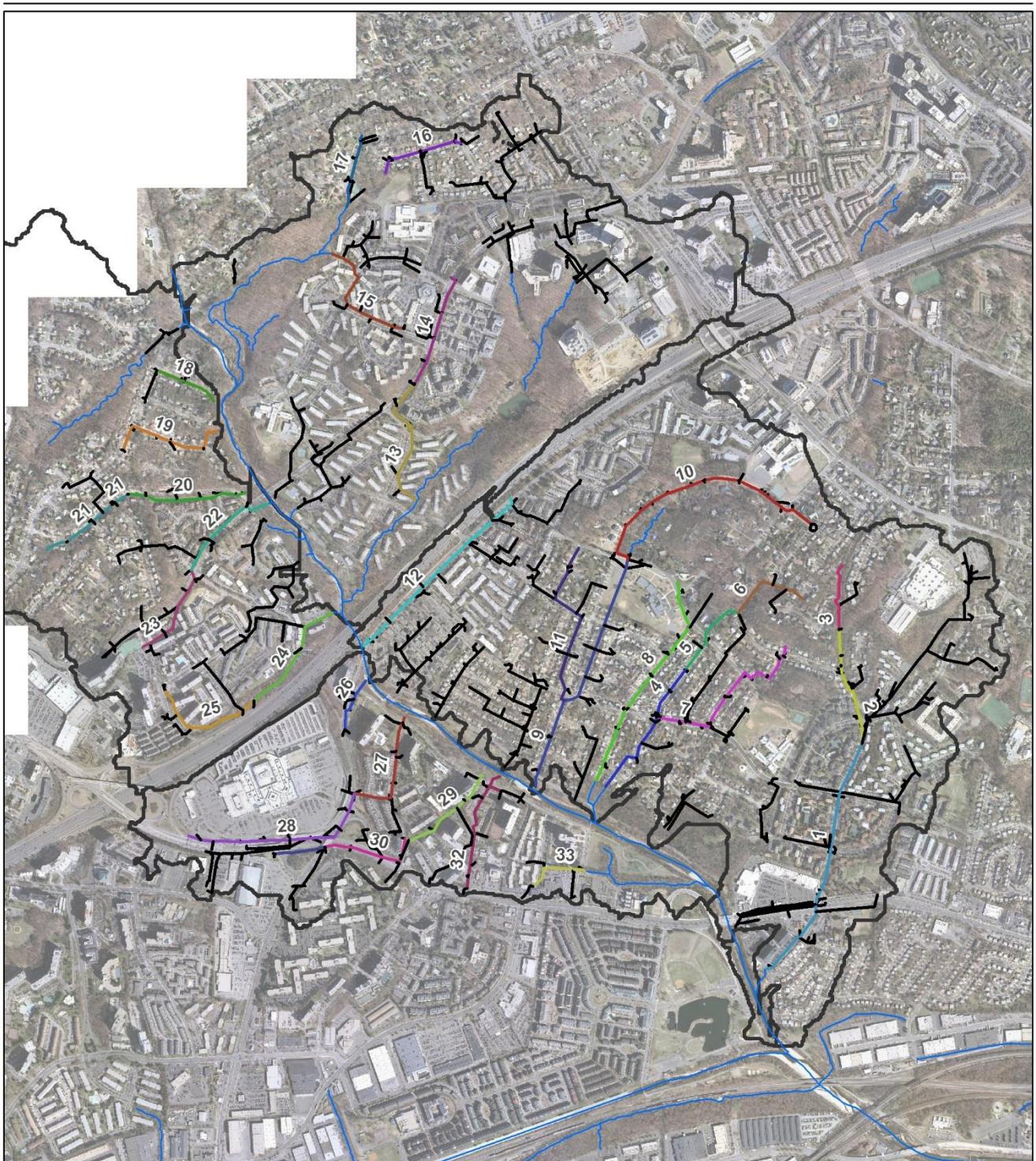
Subshed	DGravityMain FacilityID	Junction FacilityID		Length (ft)	Diameter/ Height x Width (ft)	Maximum Flow (ft <sup>3</sup> /s)	Maximum Velocity (fps)	Duration of Surcharge (hrs)		Surcharge/ Depth Above Crown (ft)		Insufficient Freeboard/ Depth Below Rim (ft)		Duration of Flooding (hrs)		Flooded Volume (ft <sup>3</sup> )		Summary Pipe Condition	
		US	DS					US	DS	US	DS	US	DS	US	DS	US	DS		
4	005948STMP	003857IN	000274IO	62	2	7.24	7.51	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	005953STMP	001259SMH	001260SMH	103	3.5	150.18	27.49	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	006048STMP	004231IN	001323SMH	78	1.5	9.77	8.87	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	006050STMP	001323SMH	001324SMH	84	2.5	9.78	8.23	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	006051STMP	001324SMH	001325SMH	144	2.5	19.92	13.83	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	006052STMP	004233IN	001324SMH	51	1.5	10.15	8.29	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	006053STMP	001379SMH	004233IN	44	1.25	10.14	11.94	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	006055STMP	001325SMH	001326SMH	111	2.5	27.91	13.38	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	006057STMP	004236IN	001326SMH	24	1.5	6.82	12.08	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	006060STMP	004239IN	004240IN	125	1.25	-5.88	4.75	0.8	0.7	2.0	Flooded	1.3	Flooded	0.0	0.1	0	51	Insufficient Freeboard	
4	006062STMP	004240IN	004241IN	61	1.25	10.71	11.21	0.7	0.9	Flooded	Flooded	Flooded	Flooded	0.1	0.9	51	3701	Flooded	
4	006063STMP	004241IN	004242IN	273	1.25	8.24	7.66	0.9	1.3	Flooded	Flooded	Flooded	Flooded	0.9	0.8	3701	2510	Flooded	
4	006064STMP	004242IN	001327SMH	113	1.25	13.28	10.54	1.3	1.3	Flooded	Flooded	Flooded	Flooded	0.8	1.3	2510	33340	Flooded	
4	006114STMP	001238SMH	001236SMH	66	2.25	56.59	18.41	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	006115STMP	001327SMH	001243SMH	112	1.5	25.03	13.75	1.3	1.3	Flooded	Flooded	3.9	Flooded	-	1.3	0.0	33340	0	Flooded
4	006117STMP	004245IN	001328SMH	12	1.5	12.13	6.82	0.3	0.3	Flooded	Flooded	Flooded	Flooded	0.3	0.3	781	1165	Flooded	
4	006118STMP	001389SMH	004245IN	72	1.25	11.74	9.39	0.3	0.3	4.0	Flooded	-	Flooded	0.0	0.3	0	781	Surcharged	
4	006120STMP	004247IN	000528ND	130	1.5	20.1	14.04	0	0.4	-	4.4	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	006124STMP	004251IN	001328SMH	276	2	43.37	13.66	0.6	0.3	Flooded	Flooded	Flooded	Flooded	0.5	0.3	7480	1165	Flooded	
4	006125STMP	001344SMH	004251IN	288	2	30.98	12.66	0.2	0.6	0.8	Flooded	1.7	Flooded	0.0	0.5	0	7480	Insufficient Freeboard	
4	006155STMP	001358SMH	001359SMH	138	1.5	12.06	11.74	0.4	0.4	6.6	12.2	0.9	0.8	0.0	0.0	0	0	Insufficient Freeboard	
4	006157STMP	001359SMH	004280IN	48	1.5	12.21	10.88	0.4	0.5	12.5	14.3	0.8	0.0	0.0	0	0	0	Insufficient Freeboard	
4	006313STMP	004327IN	001341SMH	191	1.5	11.42	6.36	0.3	0.3	3.9	5.0	1.3	0.3	0.0	0.0	0	0	Insufficient Freeboard	
4	014590STMP	001328SMH	001341SMH	195	3	89.73	12.58	0.3	0.3	Flooded	Flooded	3.5	Flooded	0.3	0.3	0.0	1165	0	Flooded
4	014591STMP	001341SMH	001340SMH	44	3	99.08	13.93	0.3	0.3	3.7	3.3	0.3	1.1	0.0	0.0	0	0	Insufficient Freeboard	
4	014603STMP	001371SMH	001342SMH	188	2	37.56	12.82	0.3	0.3	Flooded	Flooded	Flooded	Flooded	0.2	0.3	1426	2440	Flooded	
4	014604STMP	001342SMH	001328SMH	90	2	38.85	12.22	0.3	0.3	Flooded	Flooded	Flooded	Flooded	0.3	0.3	2440	1165	Flooded	
4	014610STMP	001260SMH	004056SMH	96	4	150.39	17.09	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	014611STMP	004056SMH	009062IN	44	4	150.33	12.32	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	014612STMP	009062IN	009060IN	47	4	150.37	11.77	0	0	0.2	0.0	-	-	0.0	0.0	0	0	Surcharged	
4	014613STMP	009060IN	003826IN	8	4	-150.41	11.99	0	0	0.0	-	-	-	0.0	0.0	0	0	Surcharged	
4	014622STMP	001273SMH	001245SMH	240	3	127.32	22.53	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	014625STMP	003937IN	002037ND	53	3	45.03	6.13	0	0	0.3	0.3	-	-	0.0	0.0	0	0	Surcharged	
4	014626STMP	002037ND	003875IN	107	3.5	62.61	6.65	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	014627STMP	002039ND	003854IN	141	3	87.31	24.73	0	0	-	-	-	-	0.0	0.0	0	0	Sufficient Capacity	
4	014631STMP	001340SMH	000528ND	273	3	99.14	14.45	0.3	0.4	3.4	2.9	1.1	-	0.0	0.0	0	0	Insufficient Freeboard	



**TABLE 2**  
**Holmes Run Outfall Boundary Conditions**

<b>Node ID</b>	<b>Location</b>	<b>Boundary Condition</b>
000576IO	Holmes Run	Type 1, Free Outfall
000106IO	Holmes Run	Type 1, Free Outfall
000109IO	Holmes Run	Type 1, Free Outfall
000111IO	Holmes Run	Type 1, Free Outfall
000112IO	Holmes Run	Type 1, Free Outfall
000138IO	Holmes Run	Type 1, Free Outfall
000140IO	Holmes Run	Type 1, Free Outfall
000144IO	Holmes Run	Type 1, Free Outfall
000149IO	Holmes Run	Type 1, Free Outfall
000160IO	Holmes Run	Type 1, Free Outfall
000163IO	Holmes Run	Type 1, Free Outfall
000164IO	Holmes Run	Type 1, Free Outfall
000166IO	Holmes Run	Type 1, Free Outfall
000187IO	Holmes Run	Type 1, Free Outfall
000189IO	Holmes Run	Type 1, Free Outfall
000191IO	Holmes Run	Type 1, Free Outfall
000193IO	Holmes Run	Type 1, Free Outfall
000194IO	Holmes Run	Type 1, Free Outfall
000196IO	Holmes Run	Type 1, Free Outfall
000199IO	Holmes Run	Type 1, Free Outfall
000206IO	Holmes Run	Type 1, Free Outfall
000207IO	Holmes Run	Type 1, Free Outfall
000209IO	Holmes Run	Type 1, Free Outfall
000211IO	Holmes Run	Type 1, Free Outfall
000261IO	Holmes Run	Type 1, Free Outfall
000262IO	Holmes Run	Type 1, Free Outfall
000263IO	Holmes Run	Type 1, Free Outfall
000266IO	Holmes Run	Type 1, Free Outfall
000268IO	Holmes Run	Type 1, Free Outfall
000269IO	Holmes Run	Type 1, Free Outfall
000270IO	Holmes Run	Type 1, Free Outfall
000274IO	Holmes Run	Type 1, Free Outfall
000277IO	Holmes Run	Type 1, Free Outfall
000329IO	Holmes Run	Type 1, Free Outfall
000330IO	Holmes Run	Type 1, Free Outfall





#### Legend

<b>Profiles</b>	3	7	11	15	19	23	27	31
—	—	—	—	—	—	—	—	—
N/A	4	8	12	16	20	24	28	32
—	—	—	—	—	—	—	—	—
1	5	9	13	17	21	25	29	33
—	—	—	—	—	—	—	—	—
2	6	10	14	18	22	26	30	—
—	—	—	—	—	—	—	—	—

#### Holmes Run Profile Locations

Stormwater Capacity Analysis for  
Holmes Run Watershed, City of  
Alexandria, Virginia

0 500 1,000 2,000  
Feet





FIGURE 1

**Holmes Run Profile 1 from 00149IO to 000767SMH**

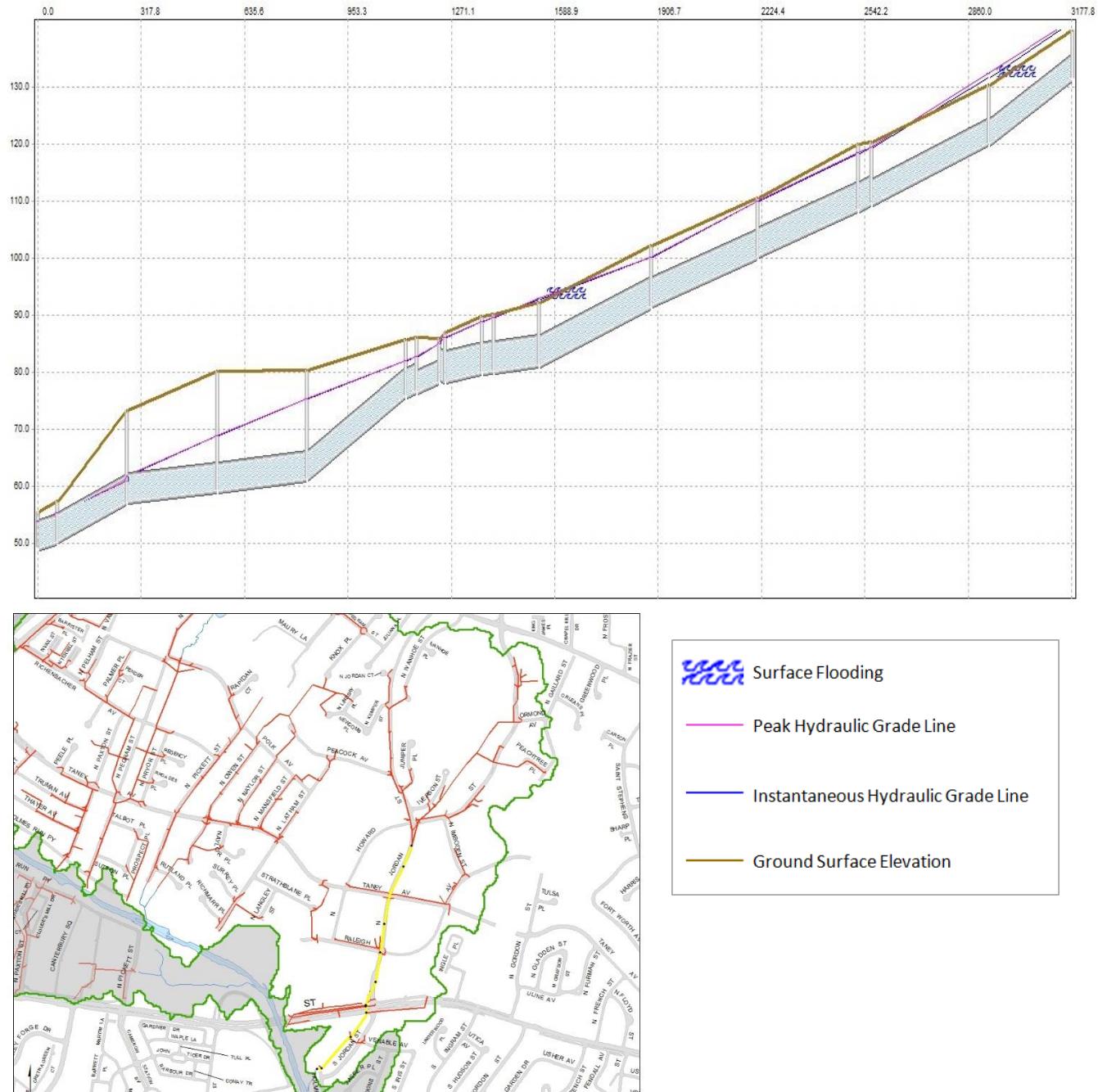


FIGURE 2

**Holmes Run Profile 2 from 000766SMH to 000957SMH**

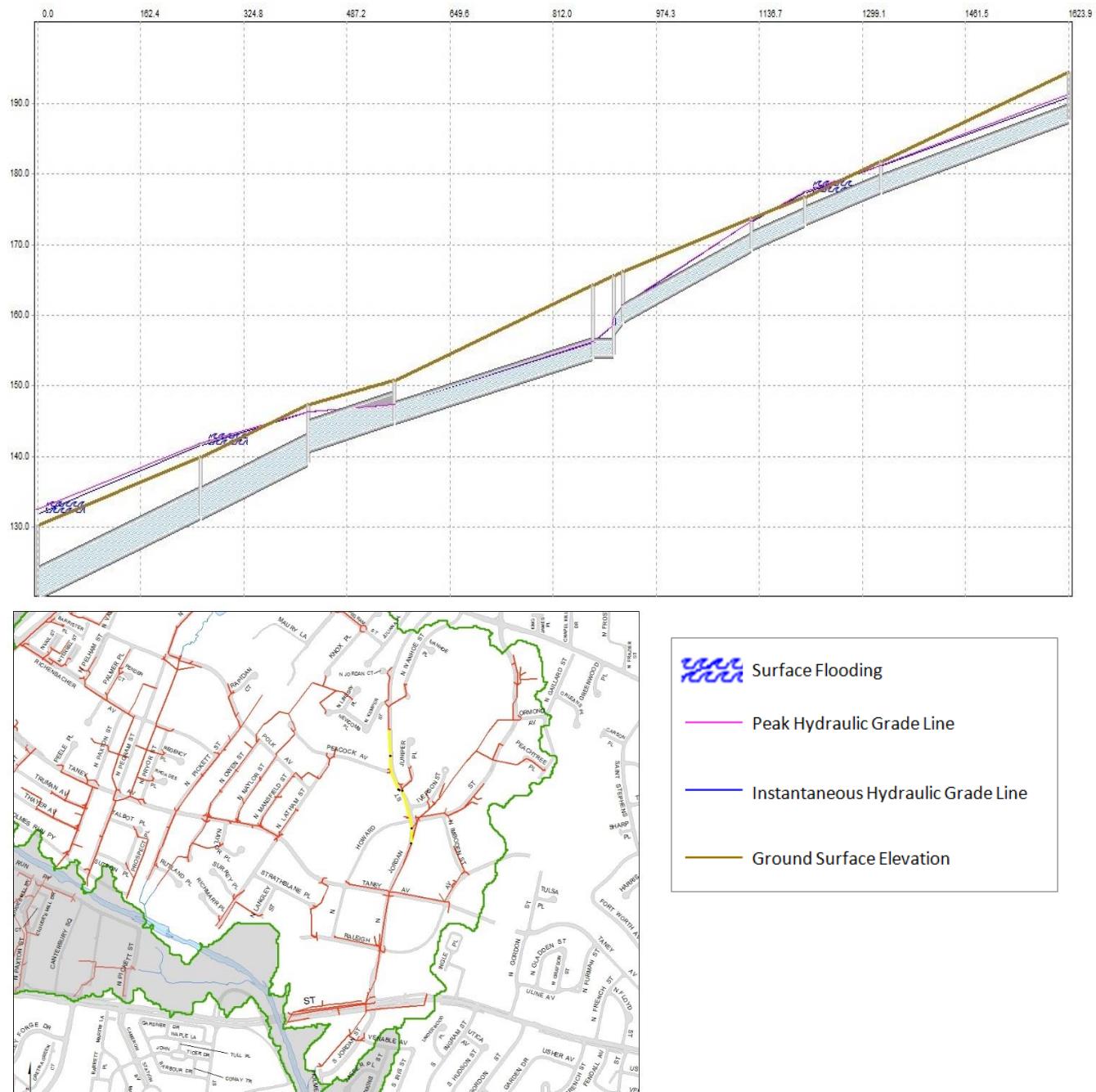


FIGURE 3

**Holmes Run Profile 3 from 000956SMH to 002690IN**

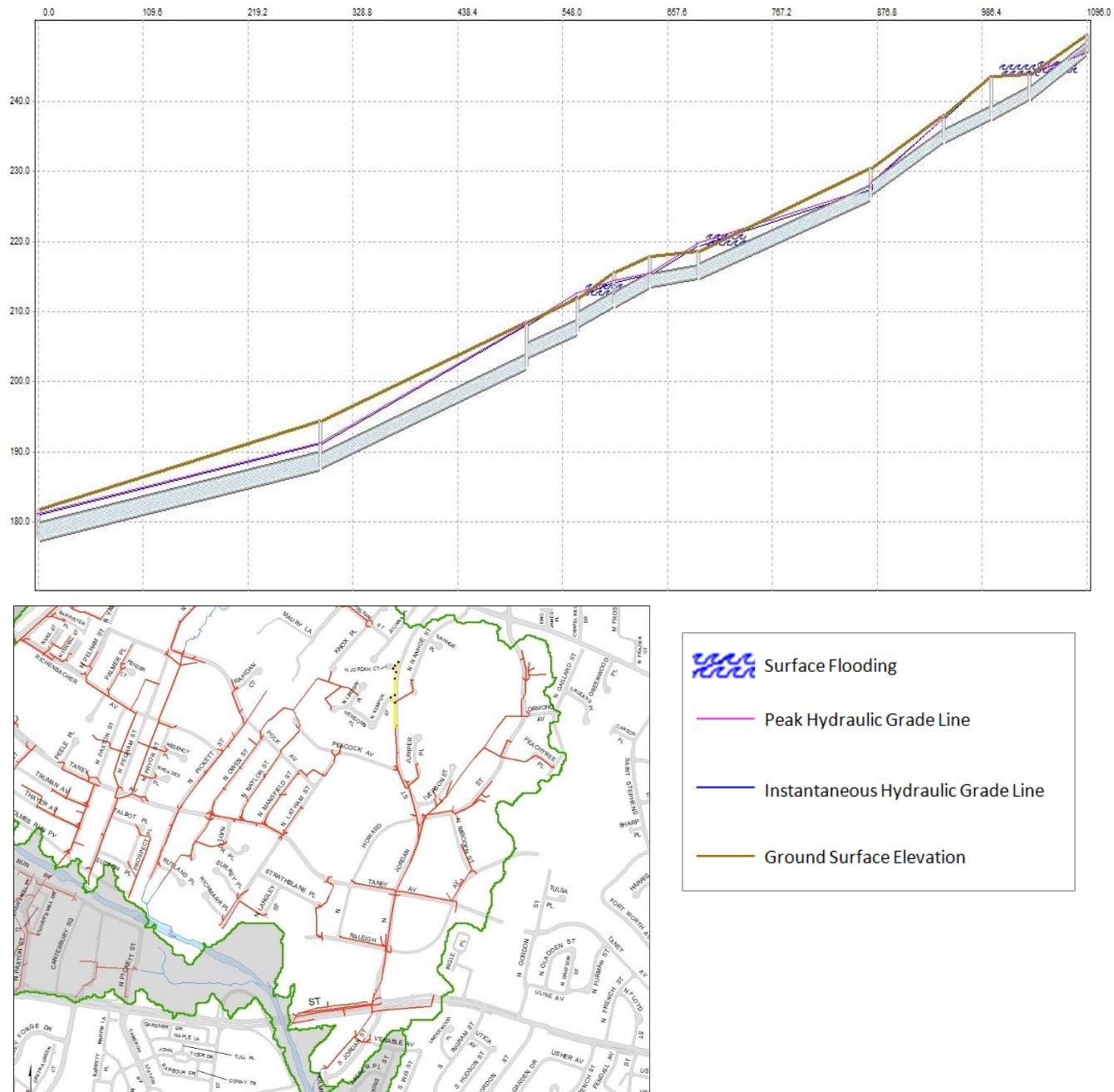


FIGURE 4

**Holmes Run Profile 4 from 000268IO to 000939SMH**

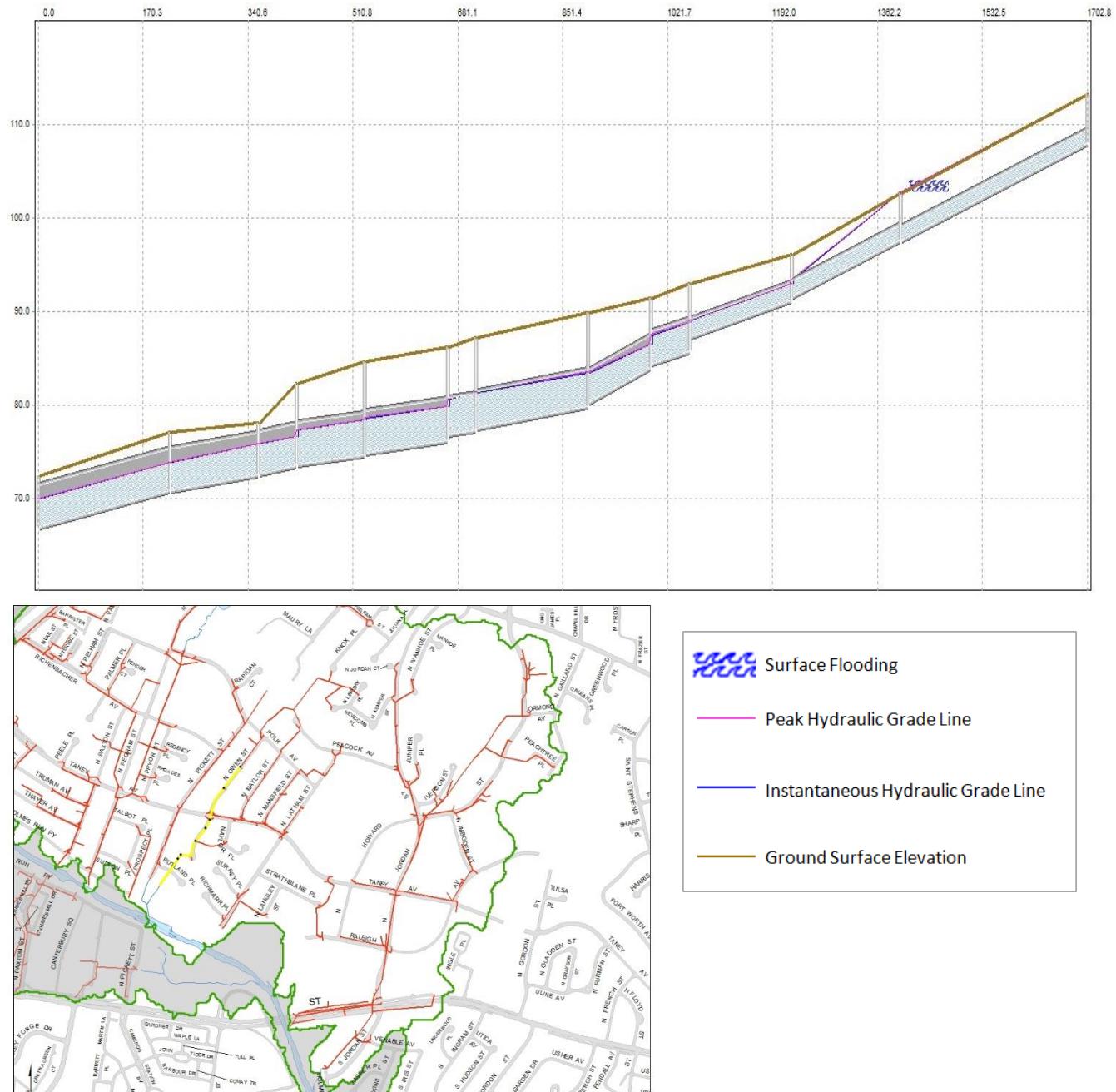


FIGURE 5

**Holmes Run Profile 5 from 000938SMH to 000991SMH**

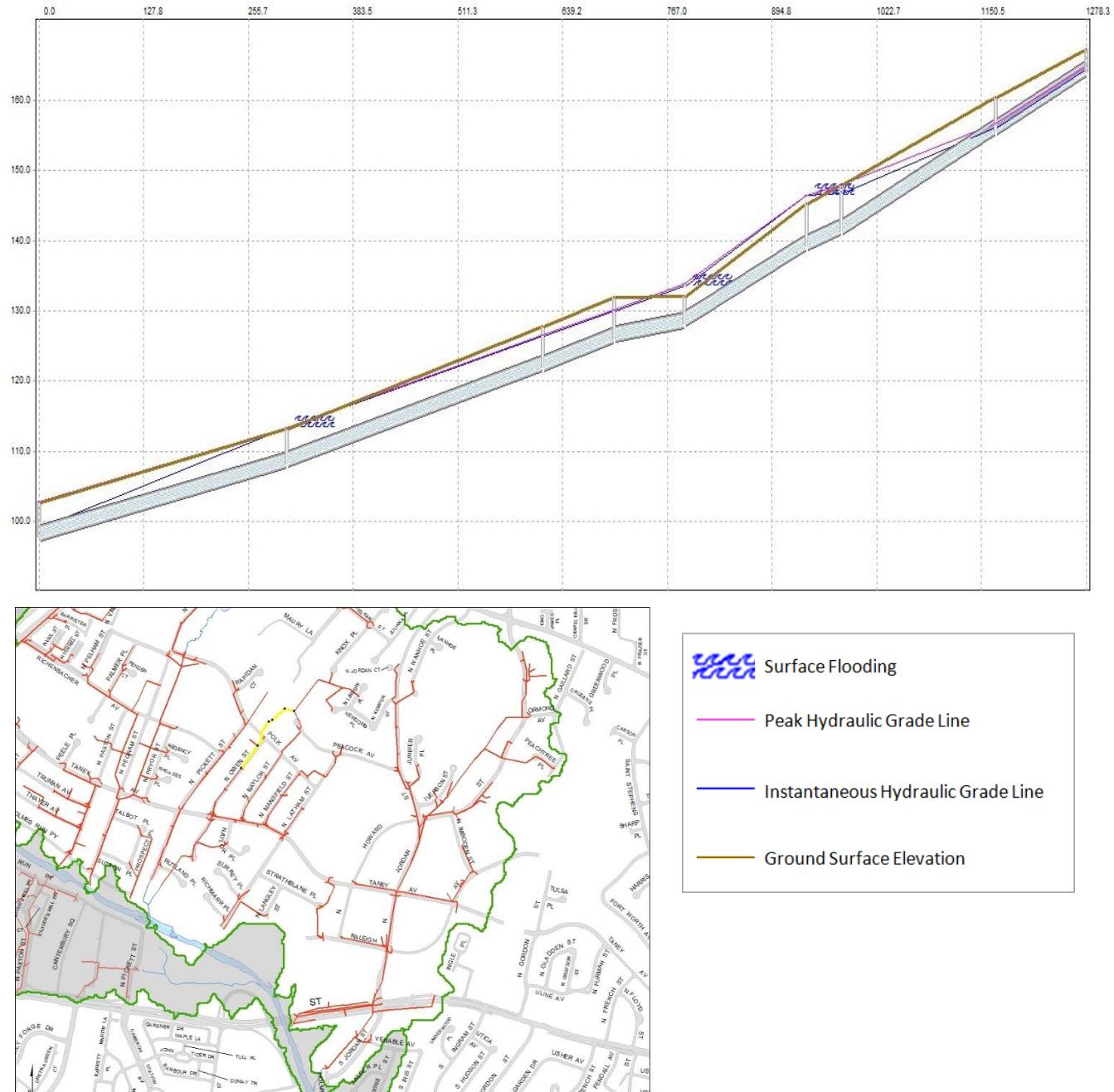


FIGURE 6

**Holmes Run Profile 6 from 000990SMH to 002683IN**

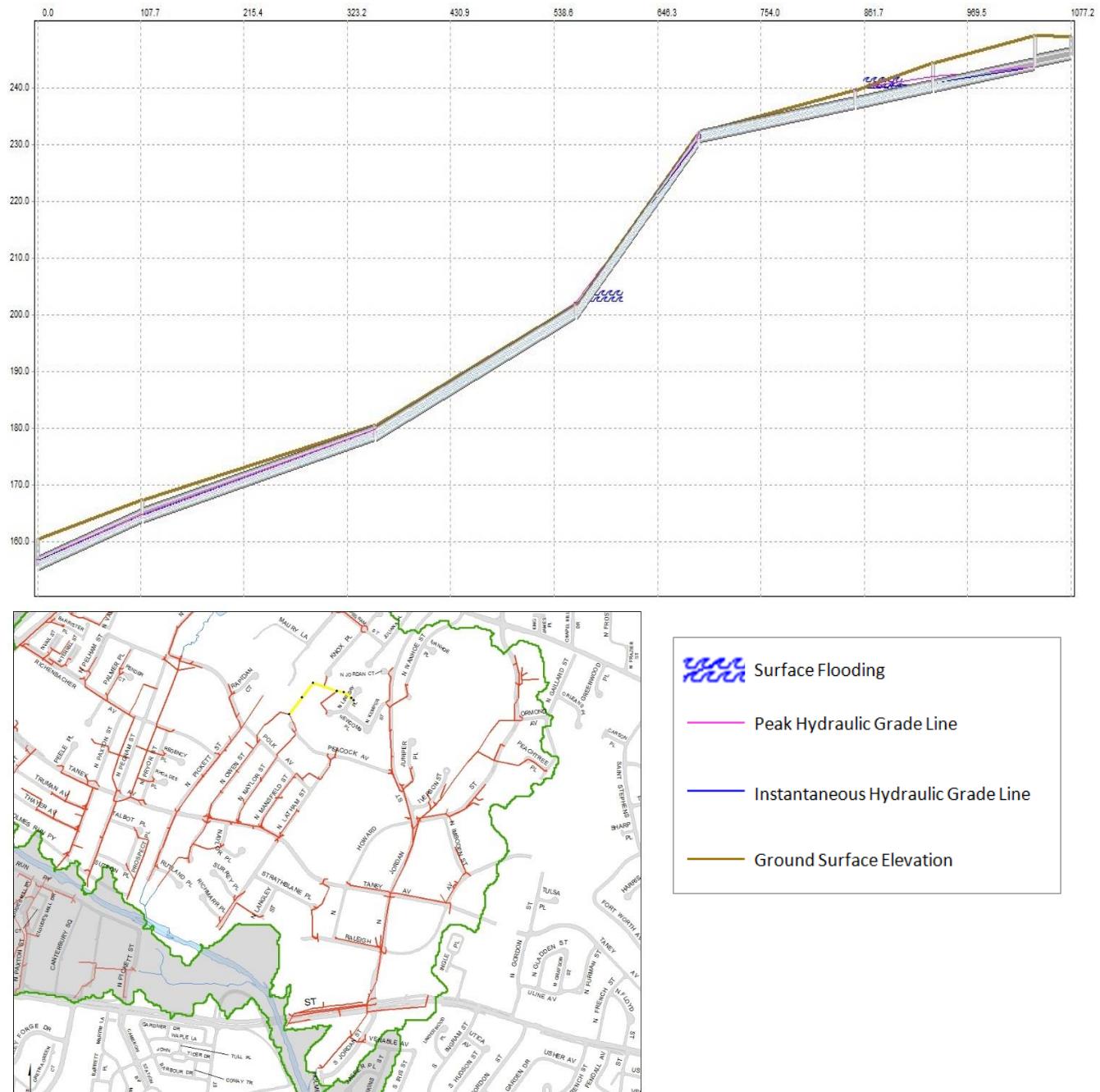


FIGURE 7

**Holmes Run Profile 7 from 000933SMH to 002694IN**

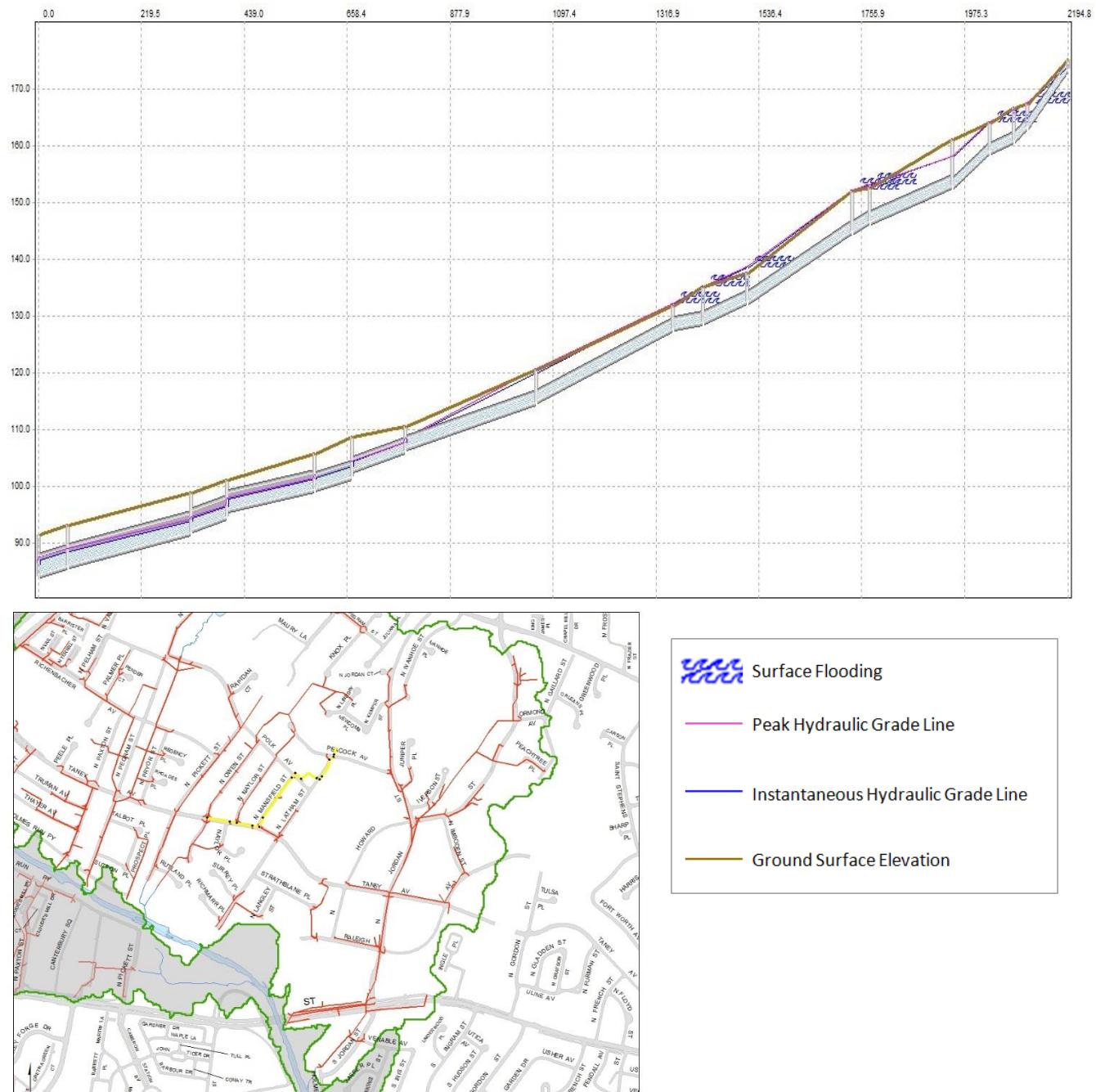


FIGURE 8

Holmes Run Profile 8 from 000266IO to 000349ND

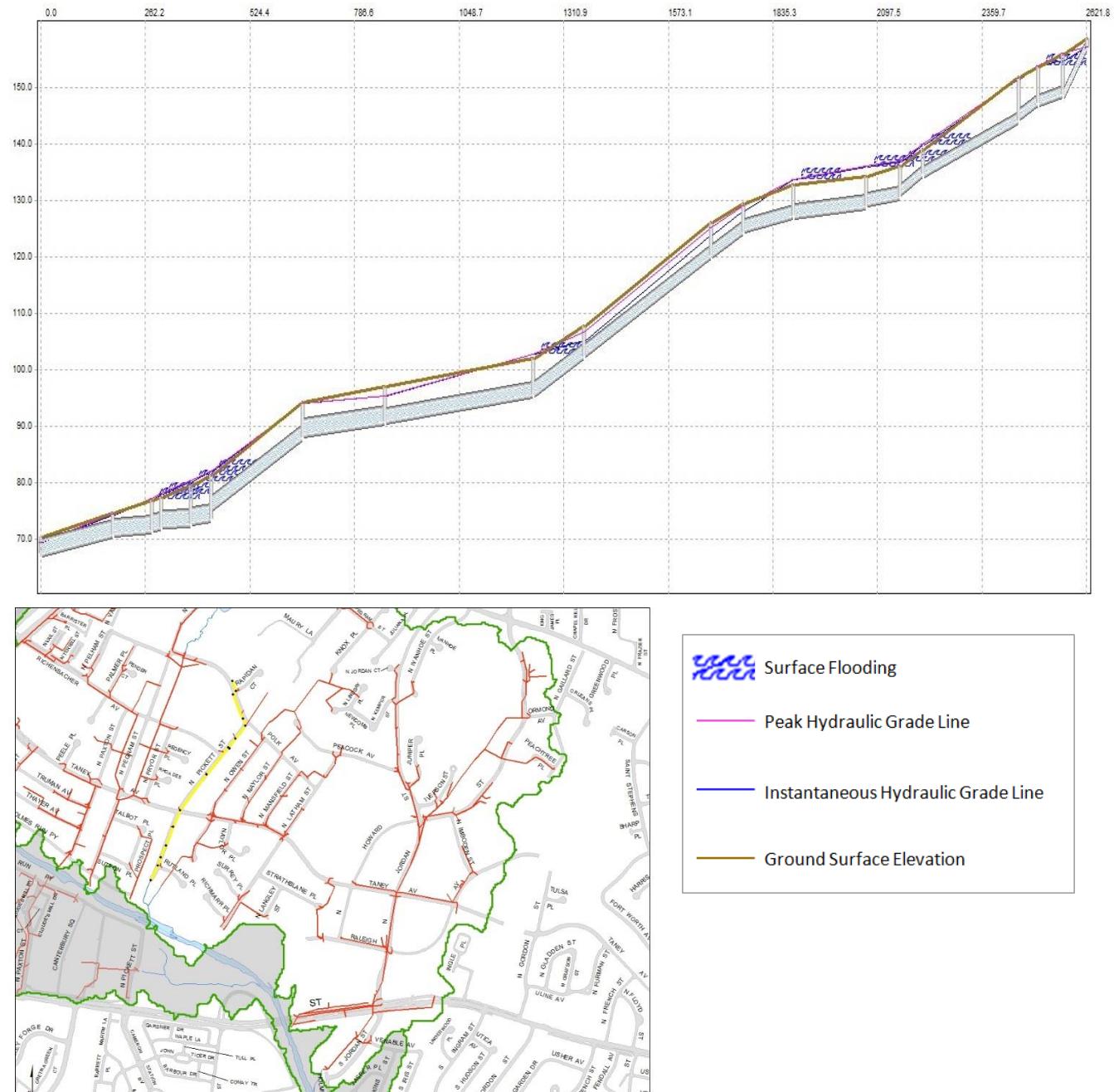
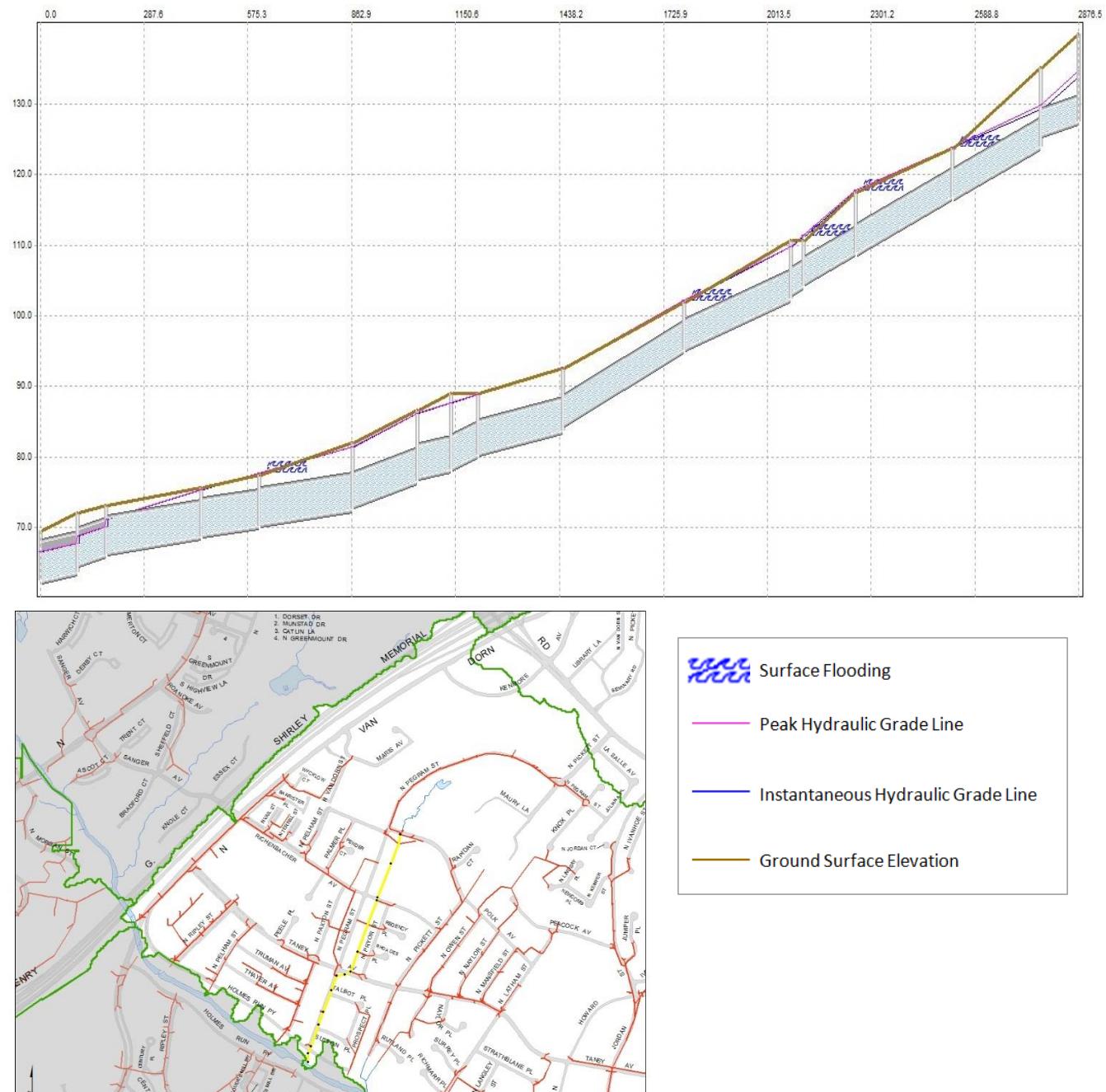


FIGURE 9

**Holmes Run Profile 9 from 000262IO to 003134IN**



## FIGURE 10

Holmes Run Profile 10 from 003133IN to 004573IN

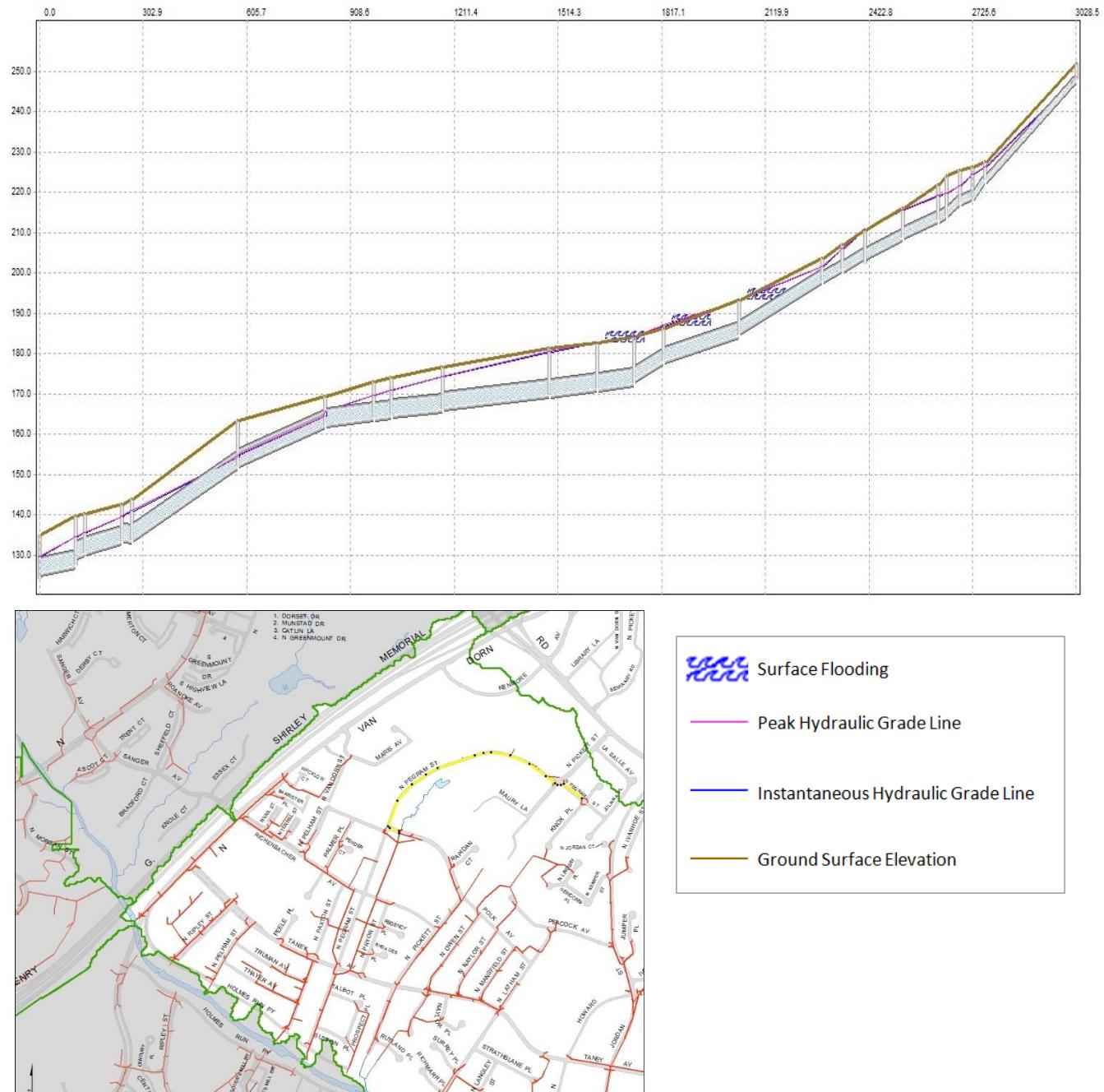


FIGURE 11

Holmes Run Profile 11 from 003207IN to 003141IN

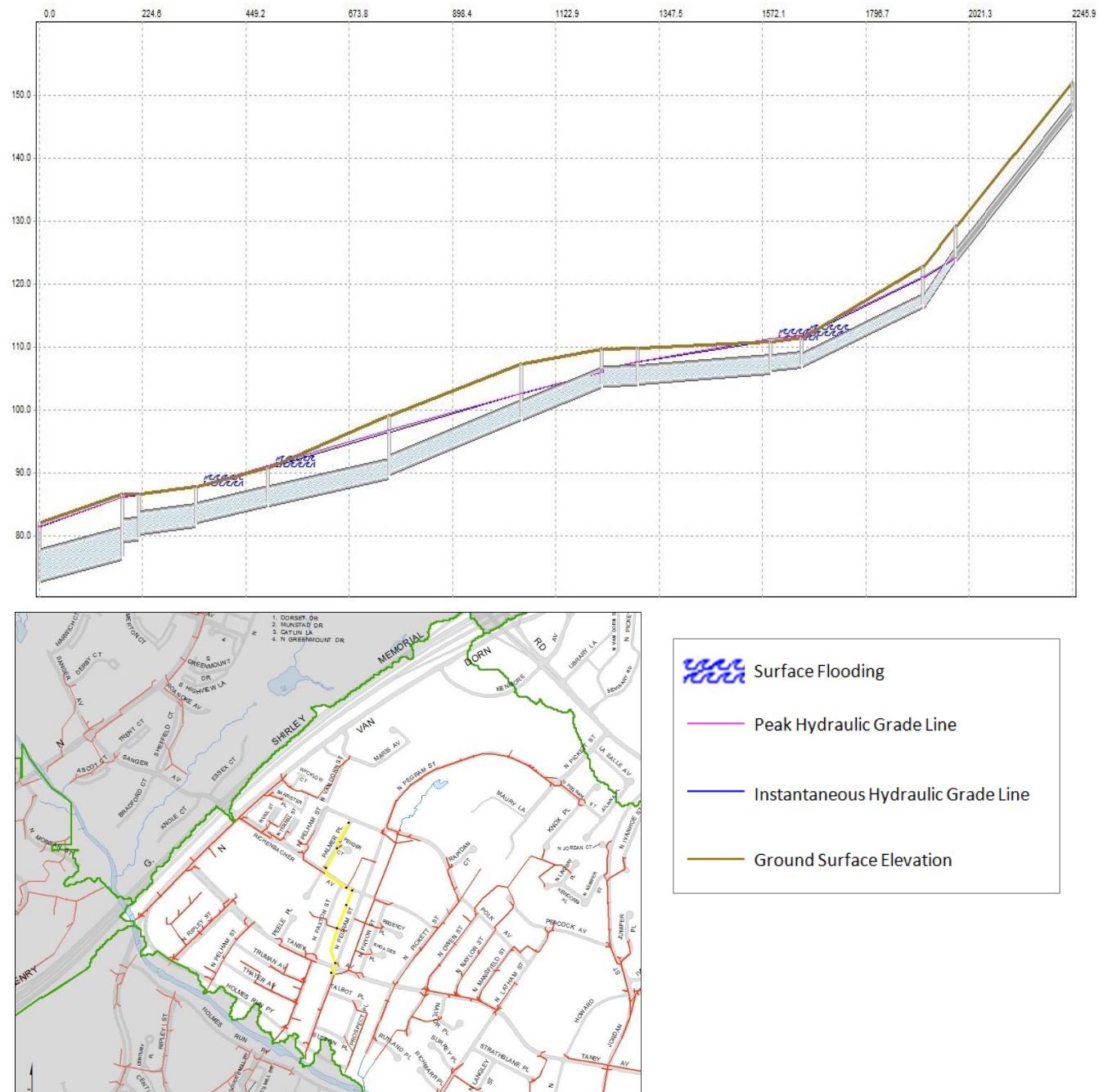


FIGURE 12

**Holmes Run Profile 12 from 000576IO to 000202IO**

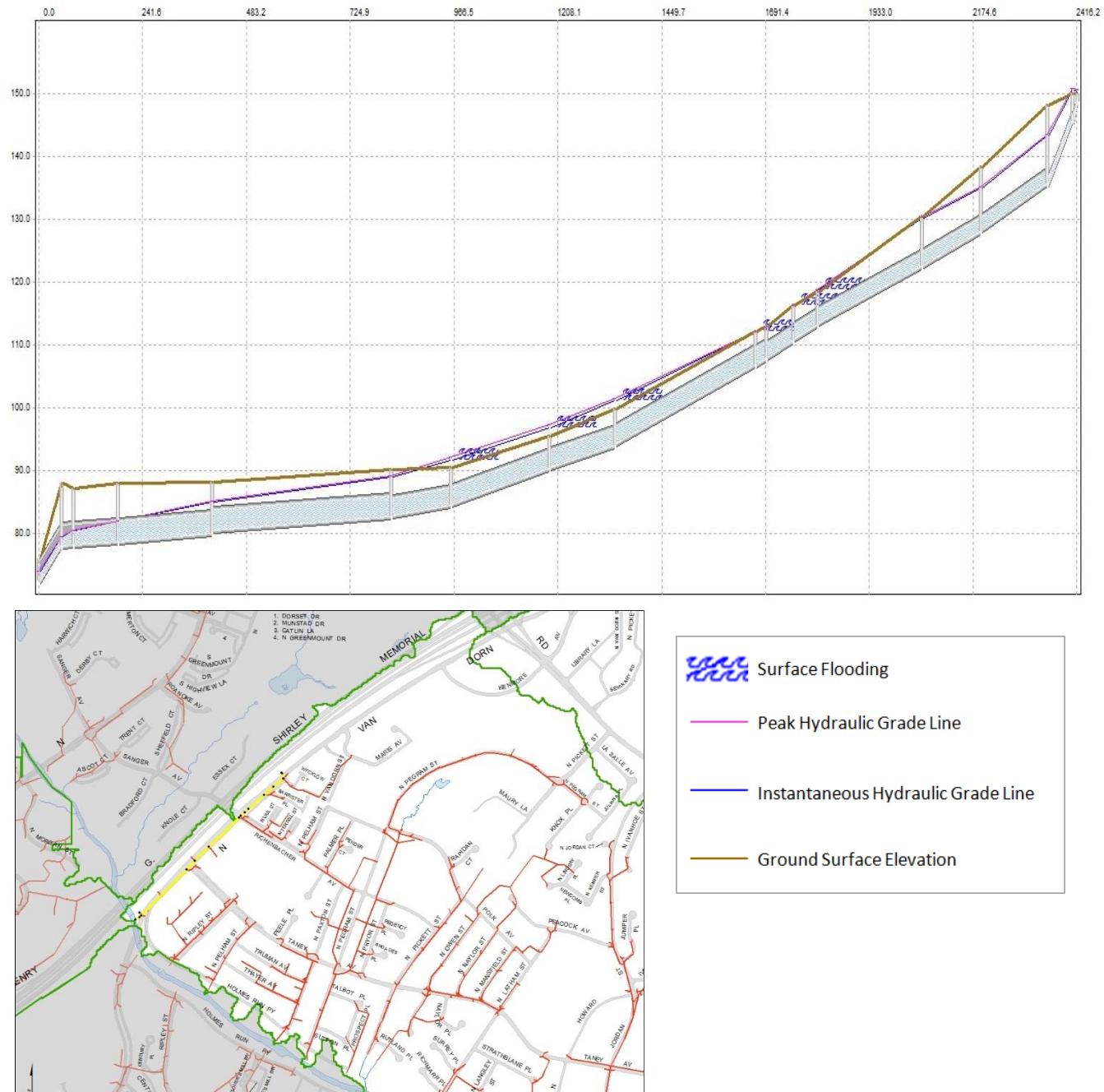


FIGURE 13

**Holmes Run Profile 13 from 000199IO to 002010IN**

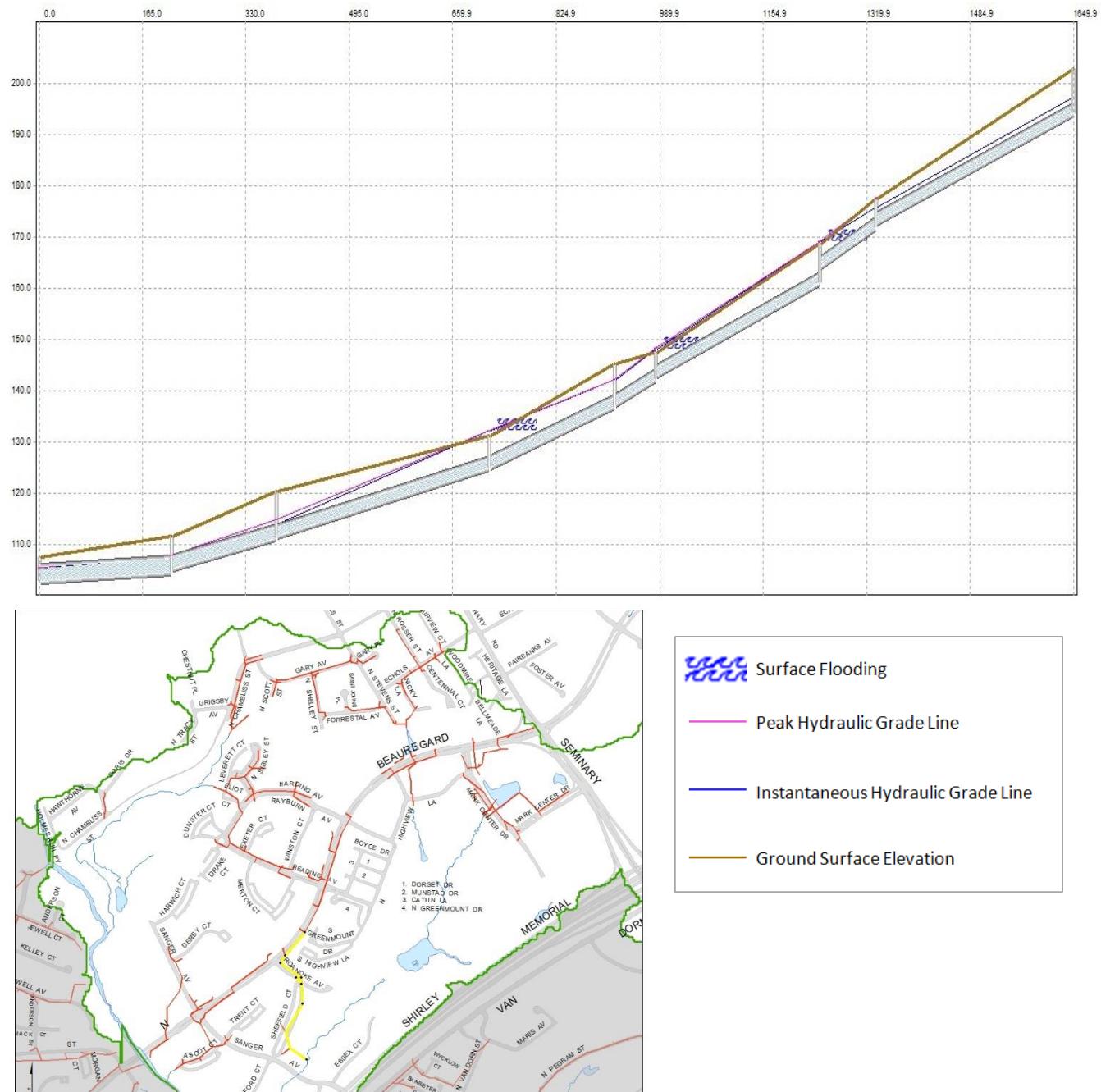


FIGURE 14

**Holmes Run Profile 14 from 000670SMH to 001926IN**

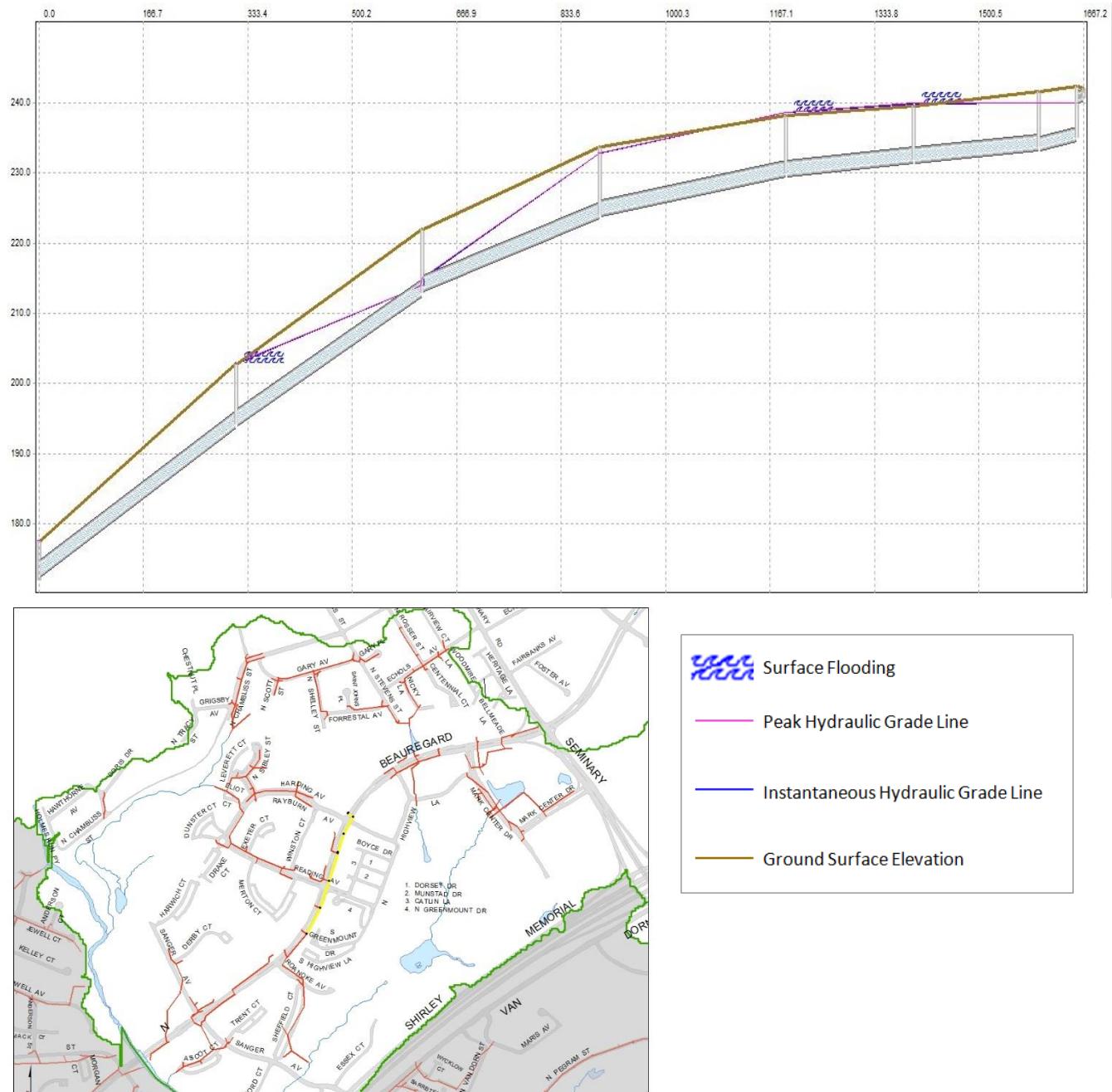
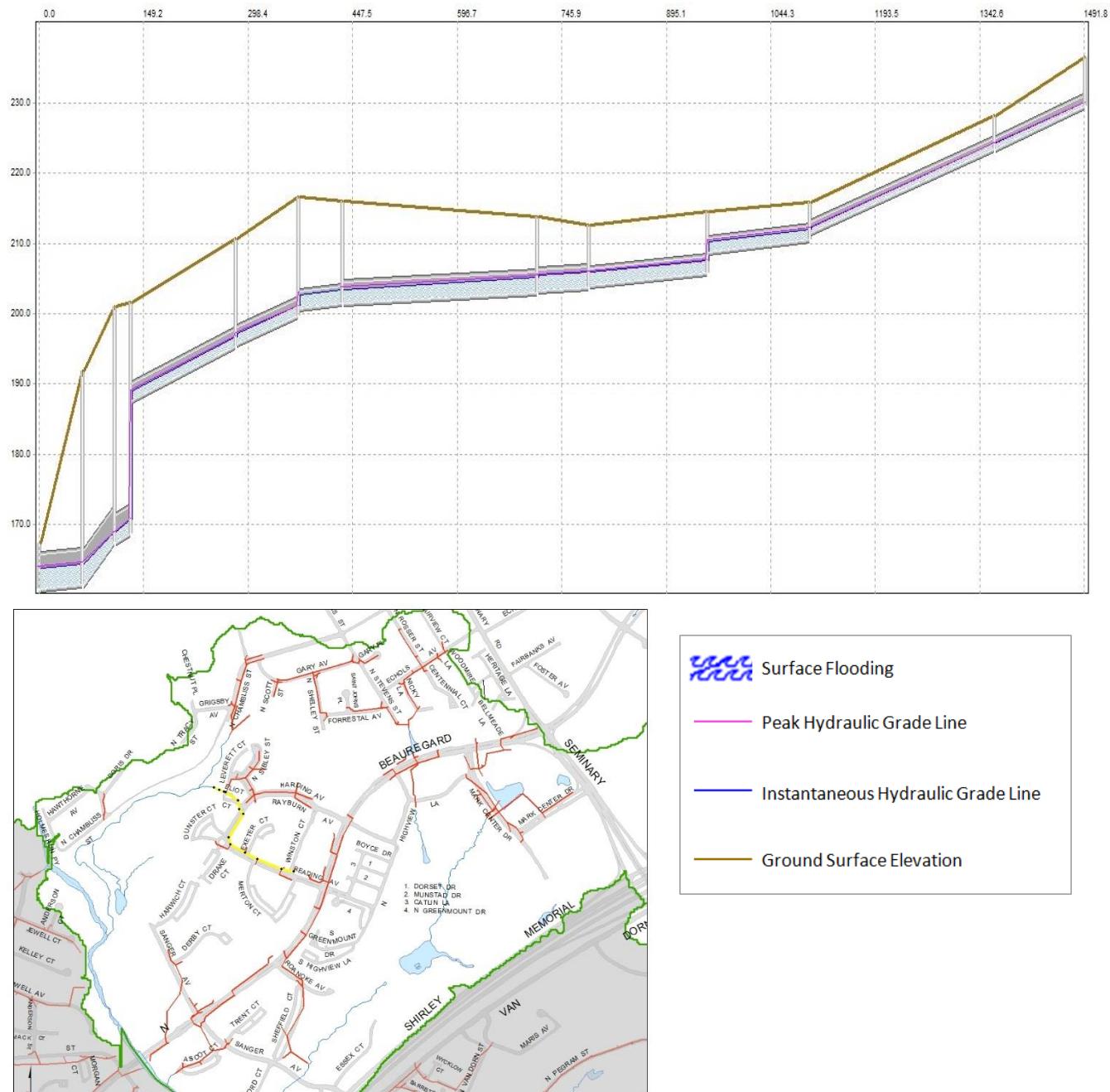


FIGURE 15

**Holmes Run Profile 15 from 000138IO to 000652SMH**



**FIGURE 16**

Holmes Run Profile 16 from 000113IO to 001561IN

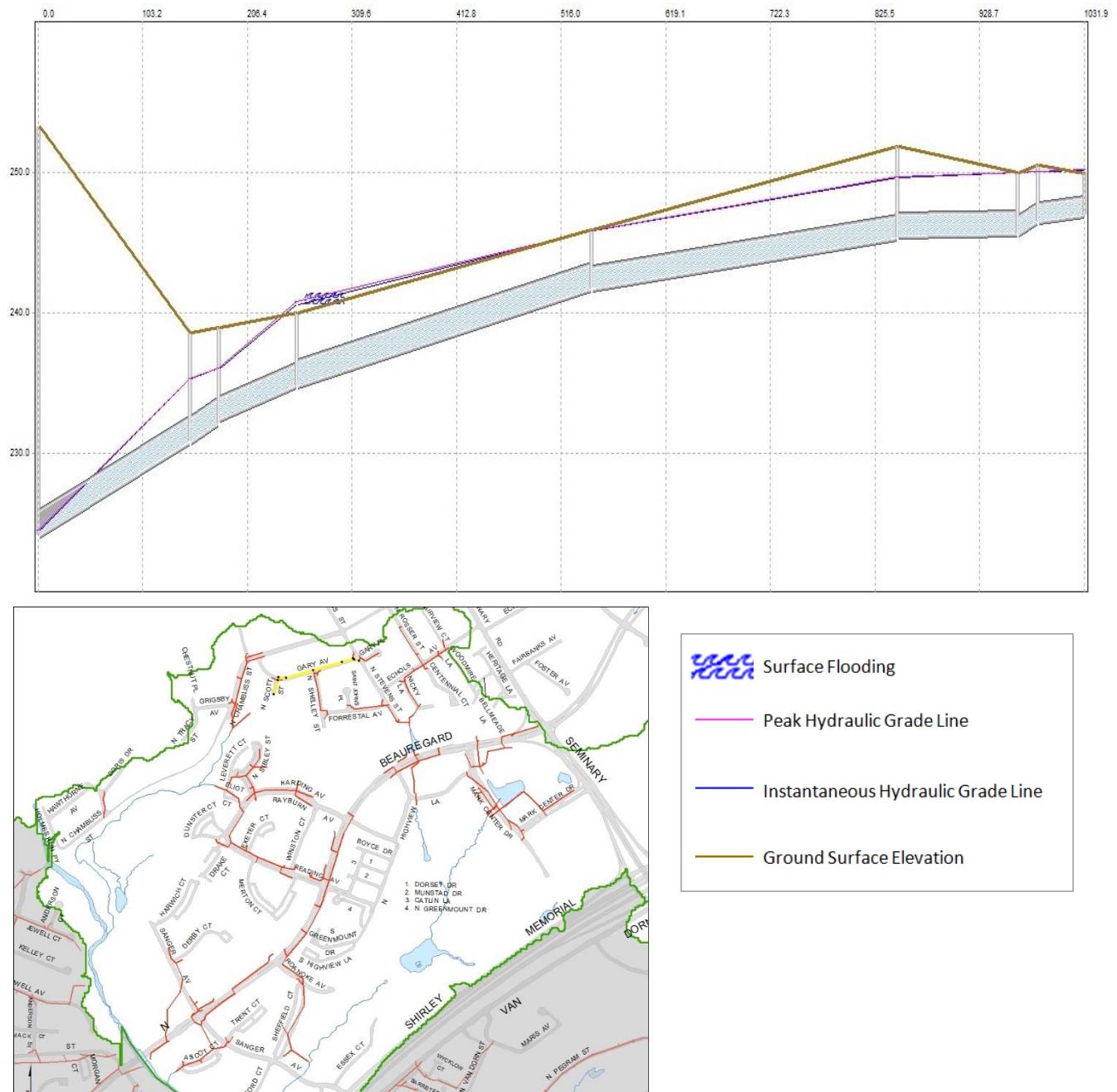


FIGURE 17

**Holmes Run Profile 17 from 000112IO to 001545IN**

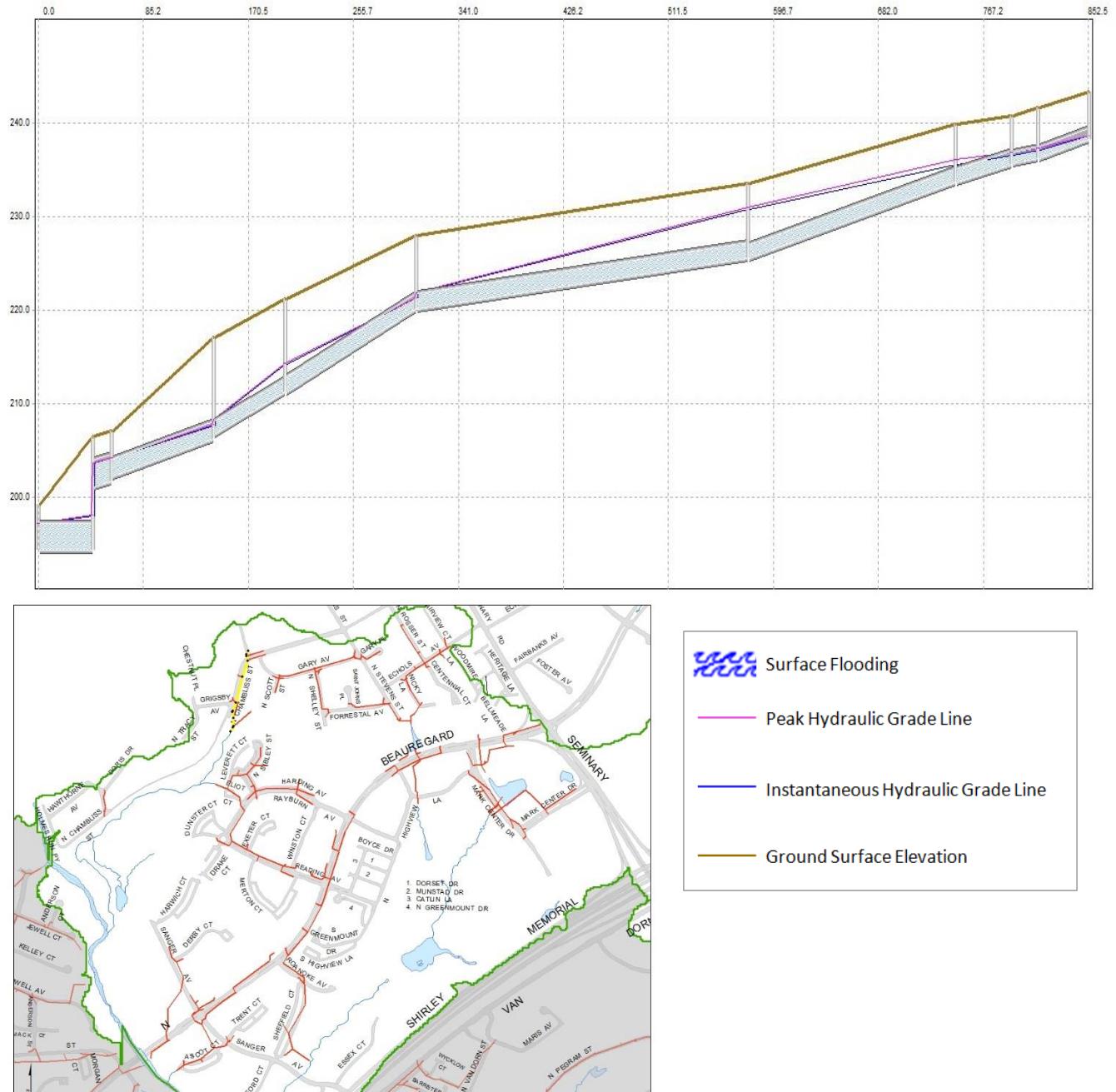


FIGURE 18

**Holmes Run Profile 18 from 000111IO to 000504SMH**

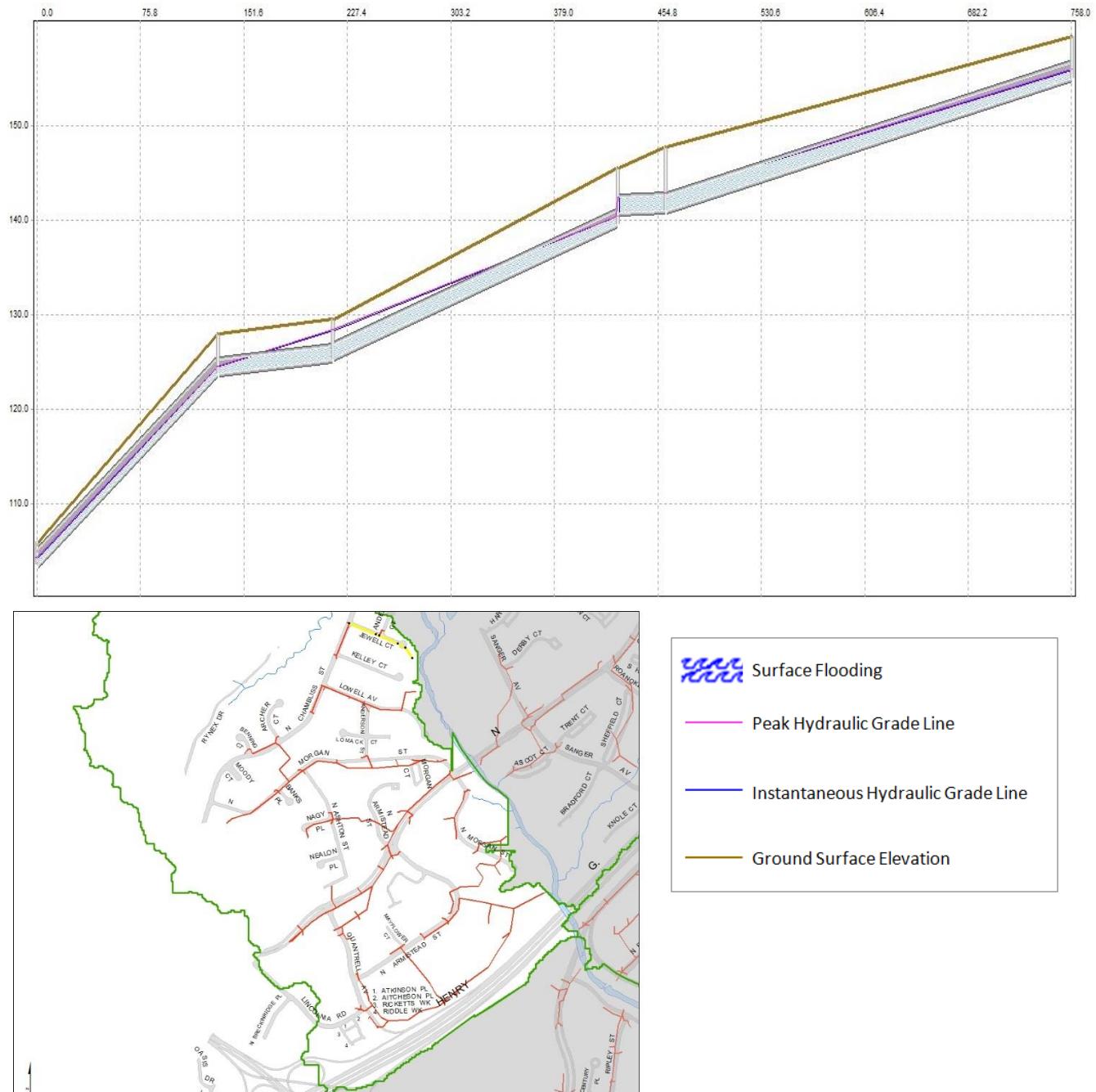


FIGURE 19

**Holmes Run Profile 19 from 000191IO to 000972SMH**

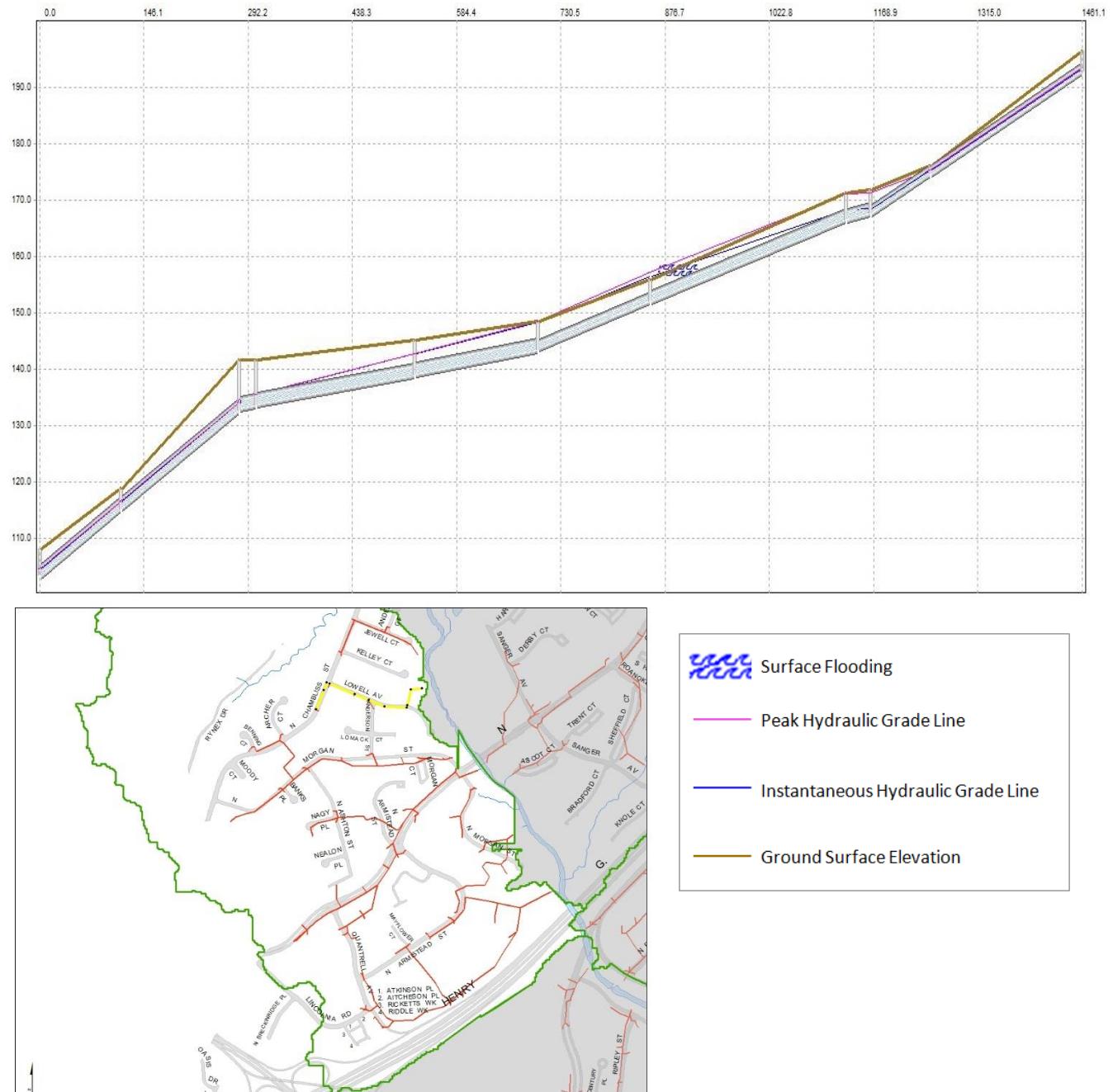


FIGURE 20

**Holmes Run Profile 20 from 000187IO to 002801IN**

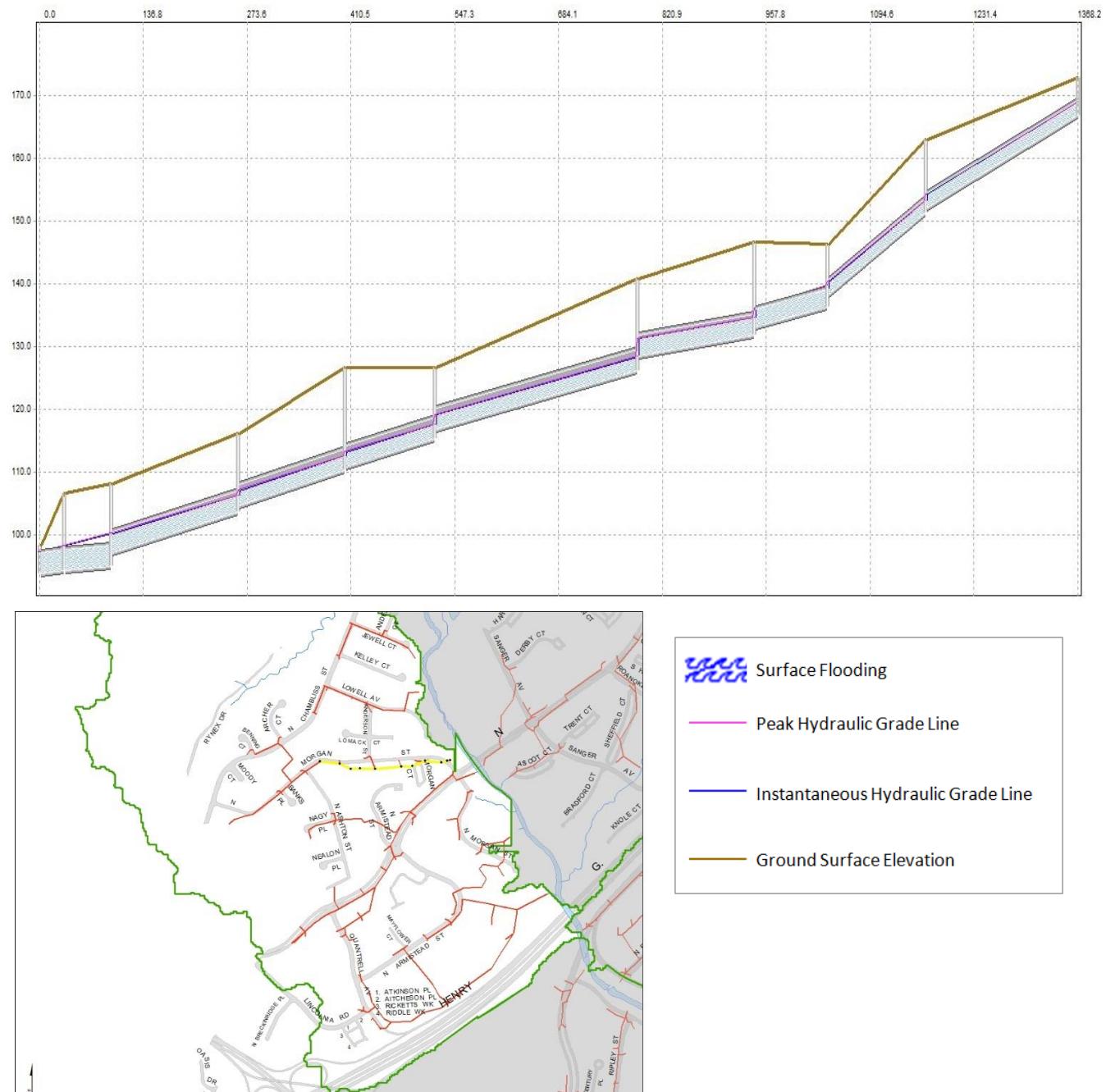


FIGURE 21

Holmes Run Profile 21 from 002803IN to 000340ND

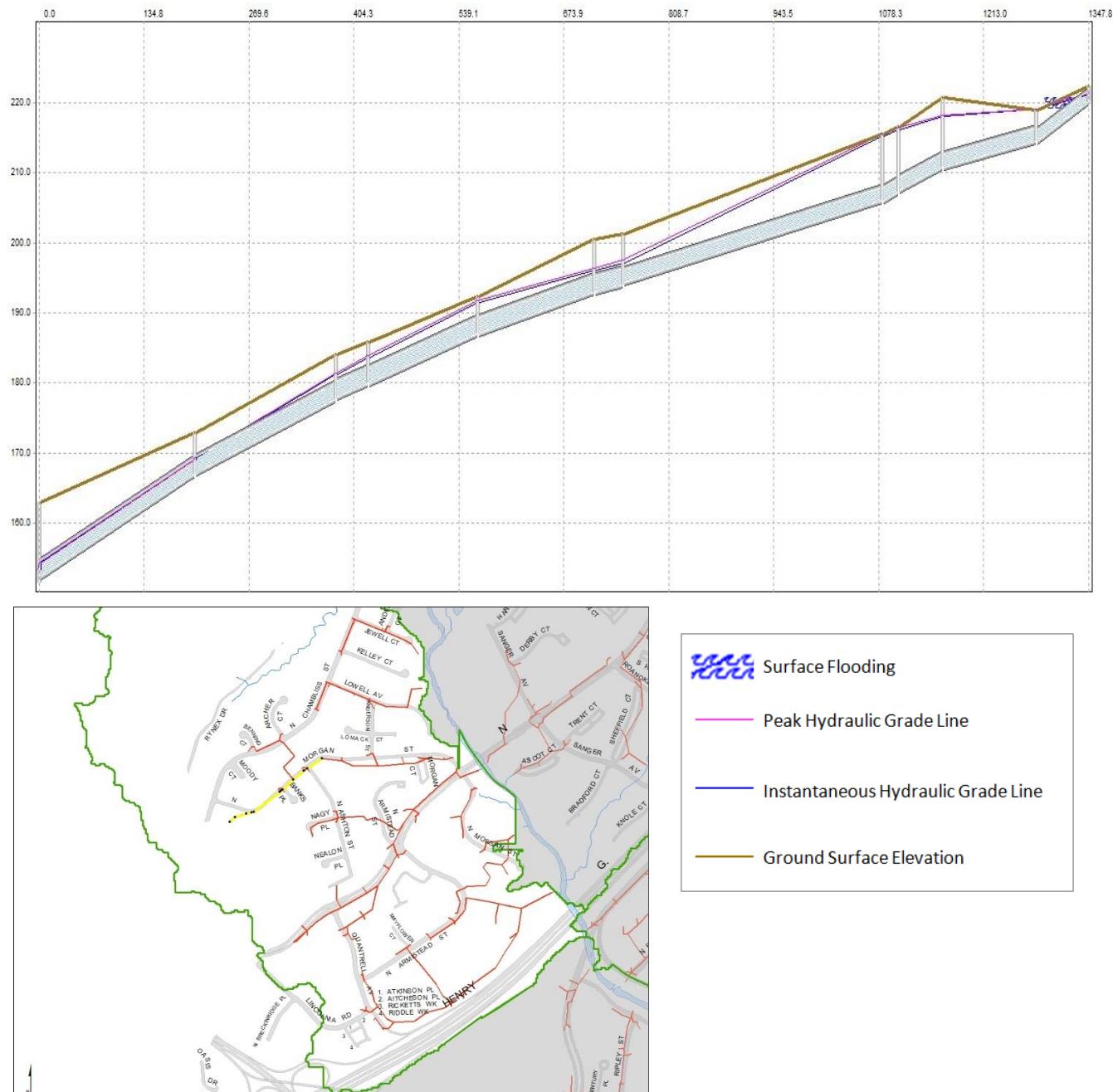


FIGURE 22

**Holmes Run Profile 22 from 000189IO to 001521SMH**

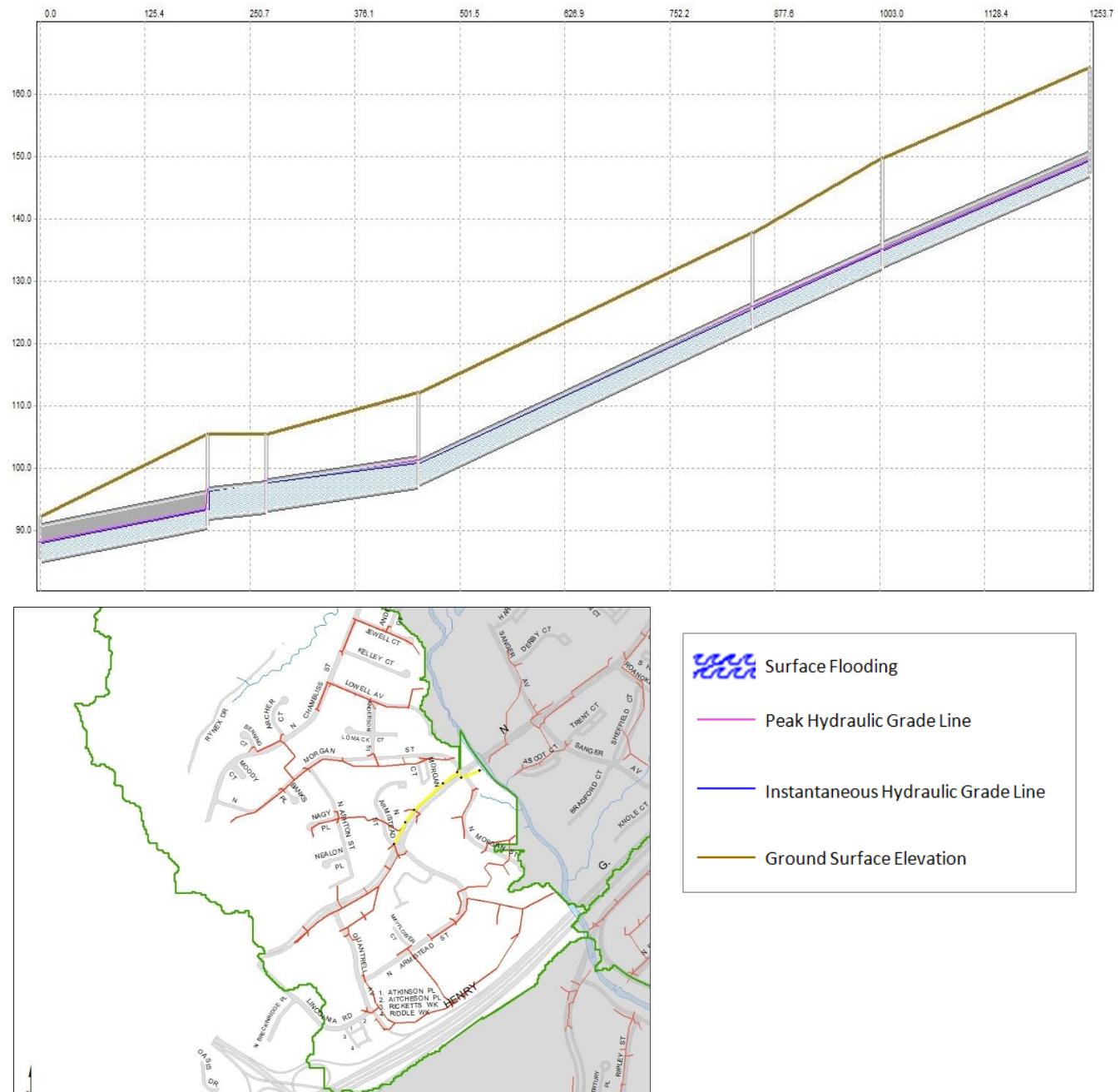


FIGURE 23

**Holmes Run Profile 23 from 002916IN to 001525SMH**

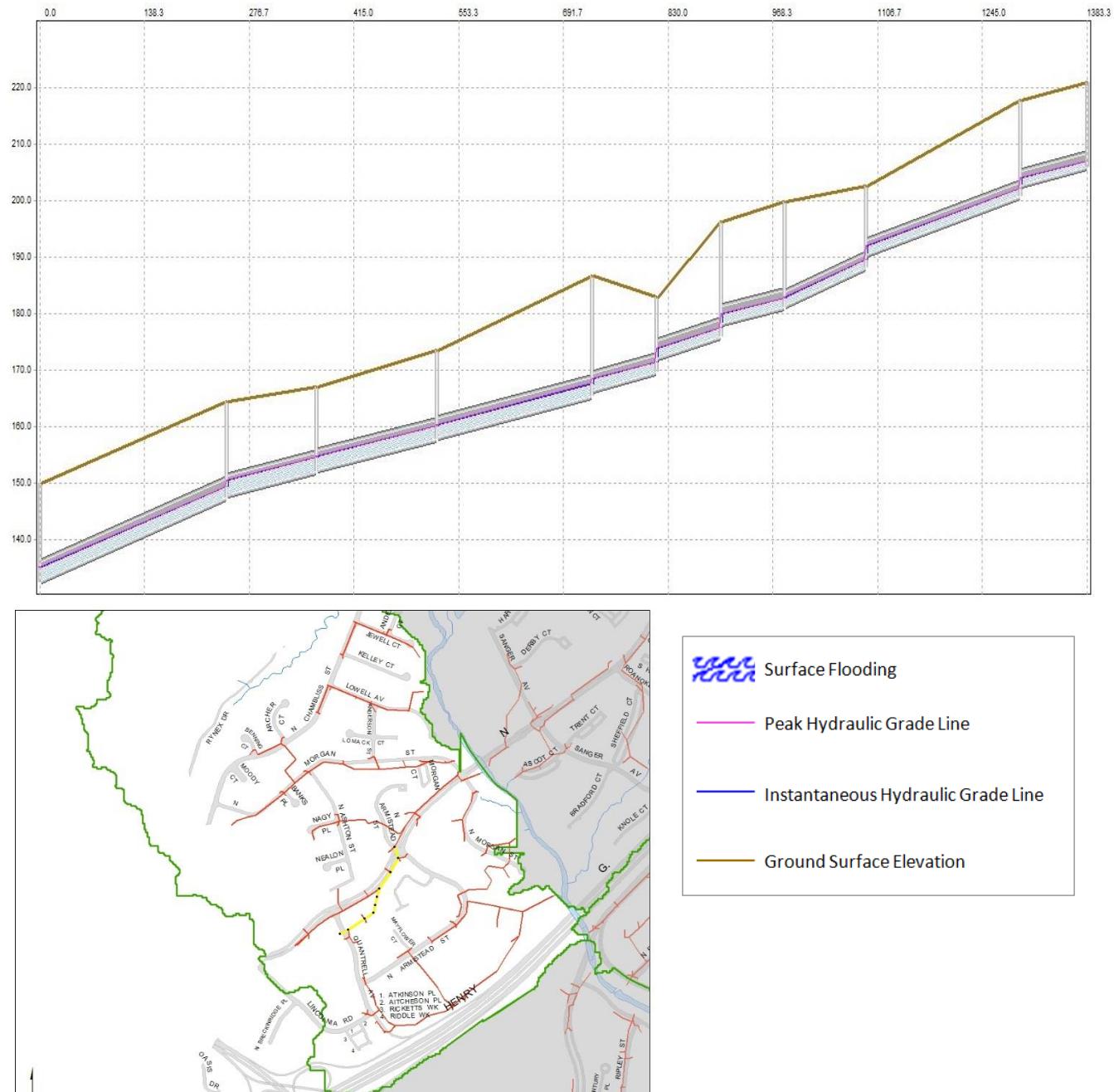


FIGURE 24

**Holmes Run Profile 24 from 000330IO to 004758IN**

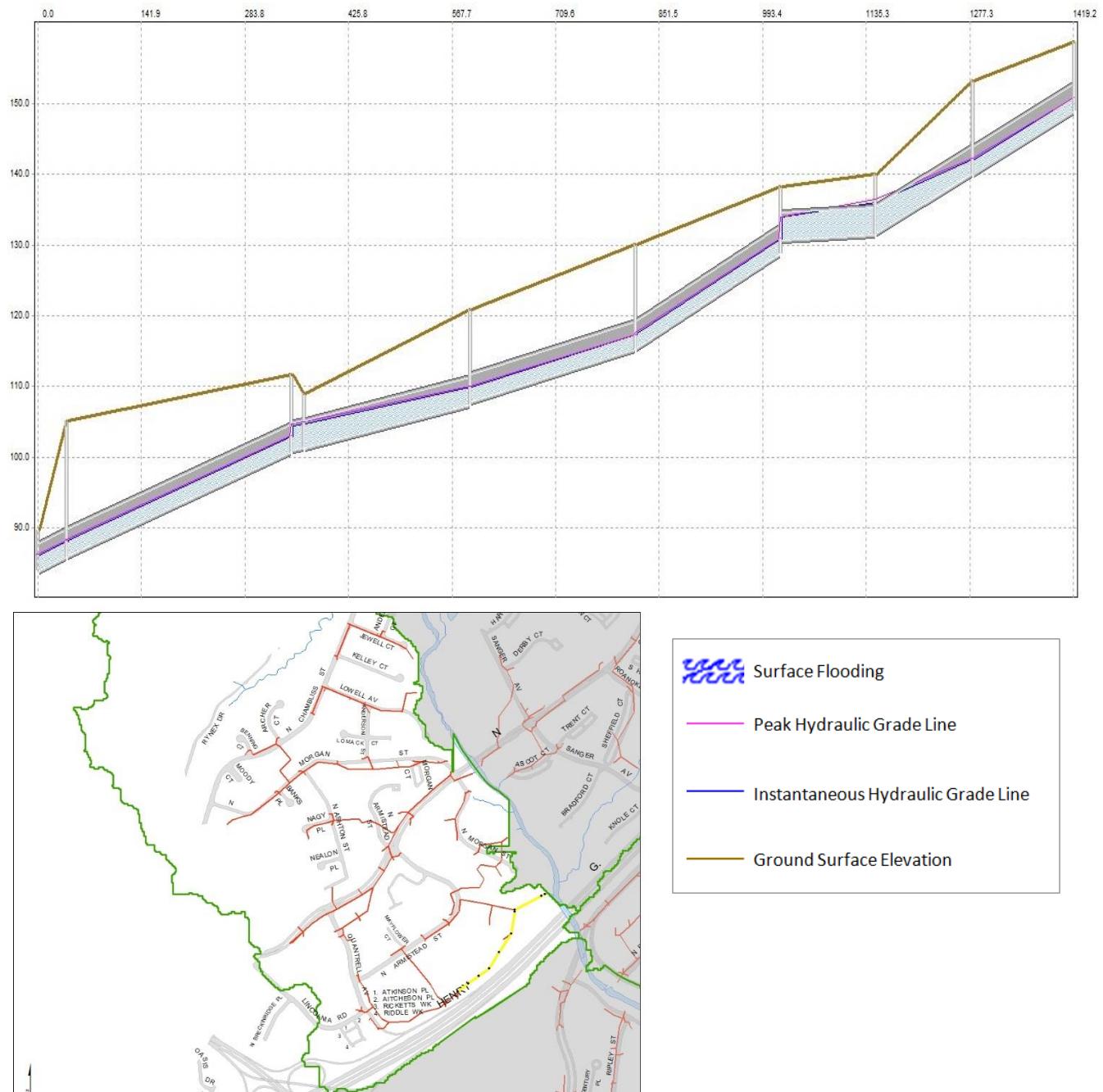


FIGURE 25

**Holmes Run Profile 25 from 004757IN to 004711IN**

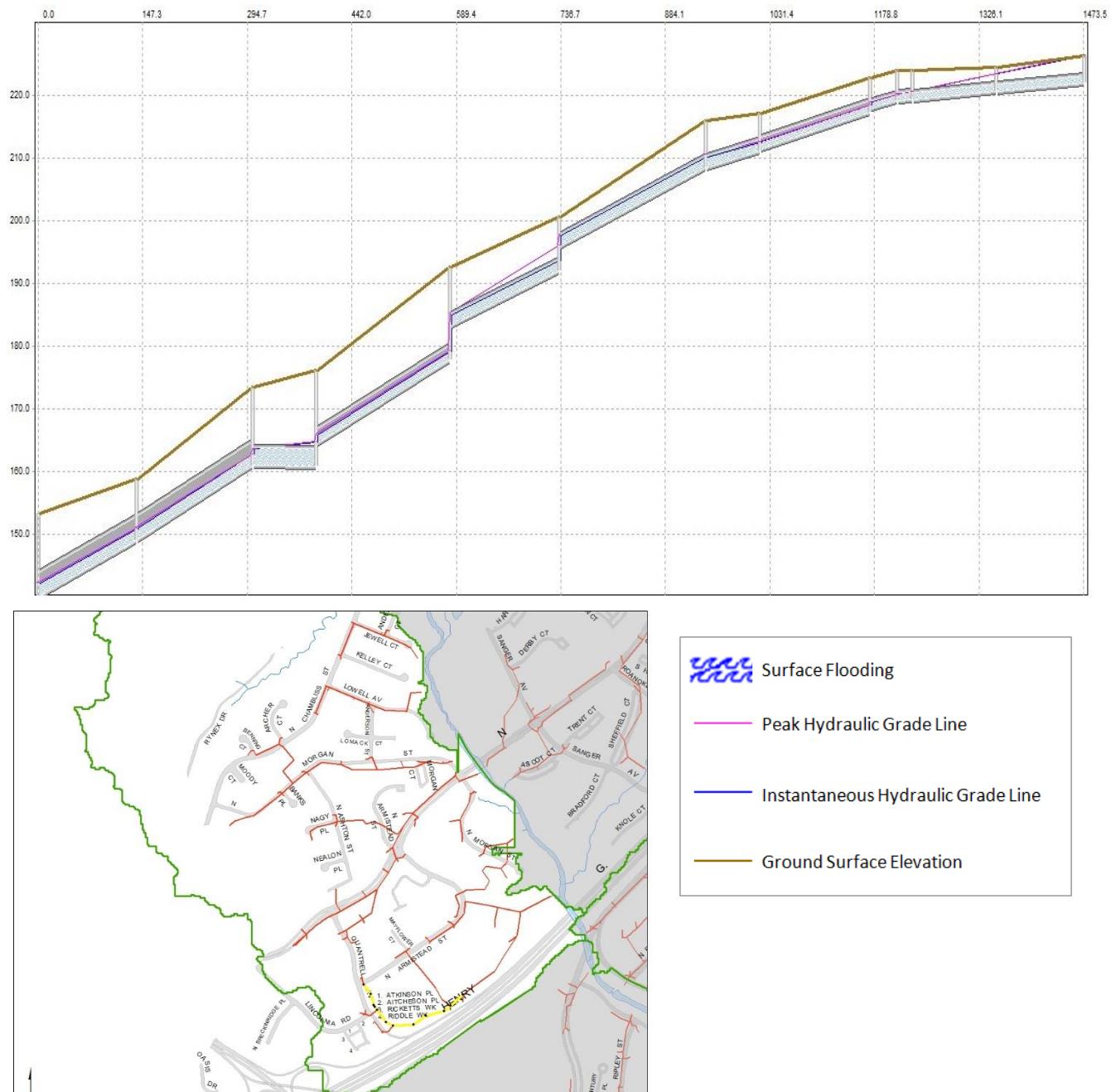


FIGURE 26

**Holmes Run Profile 26 from 000207IO to 003331IN**

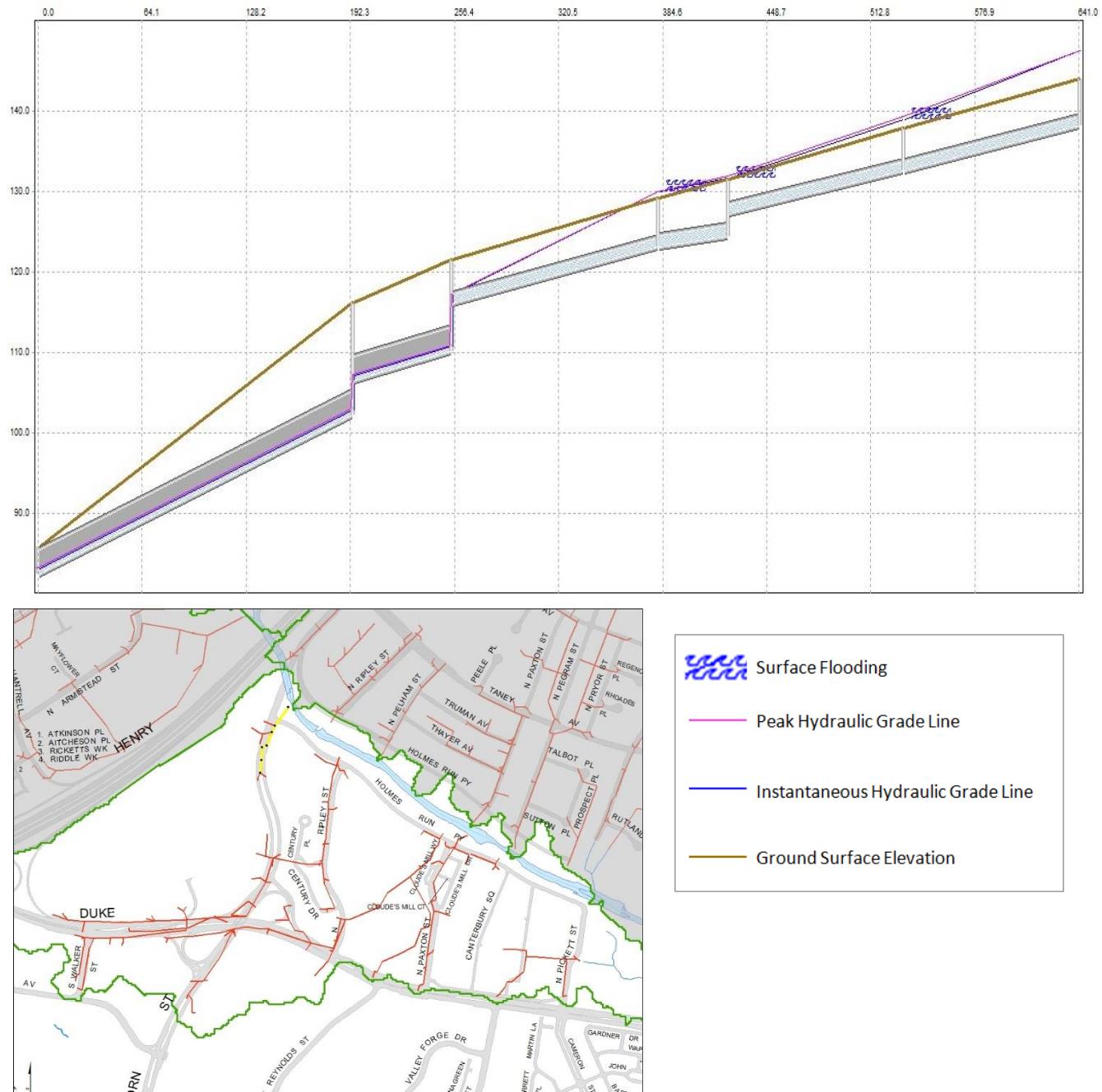


FIGURE 27

**Holmes Run Profile 27 from 000211IO to 001245SMH**

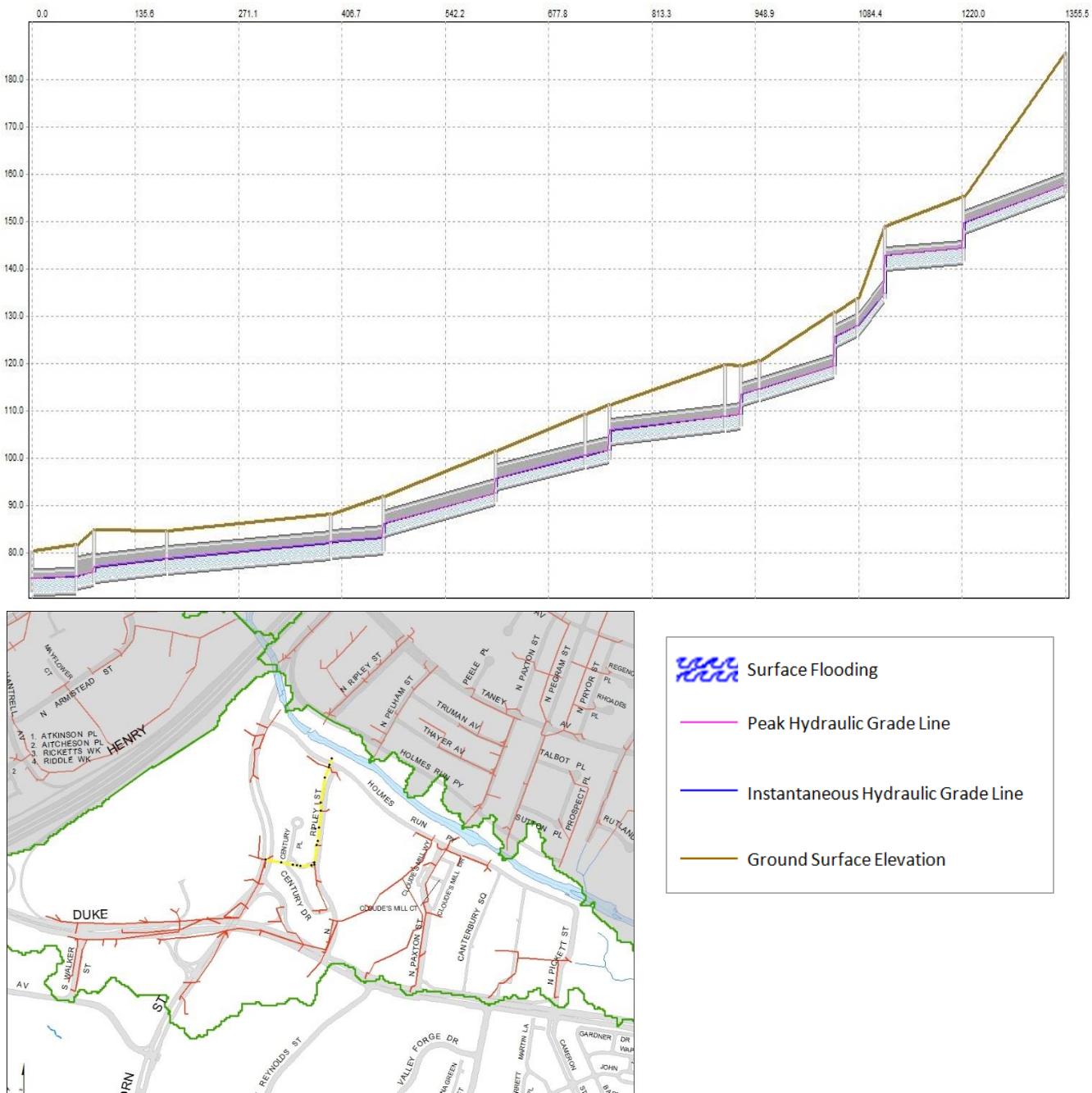


FIGURE 28

**Holmes Run Profile 28 from 001231SMH to 000280IO**

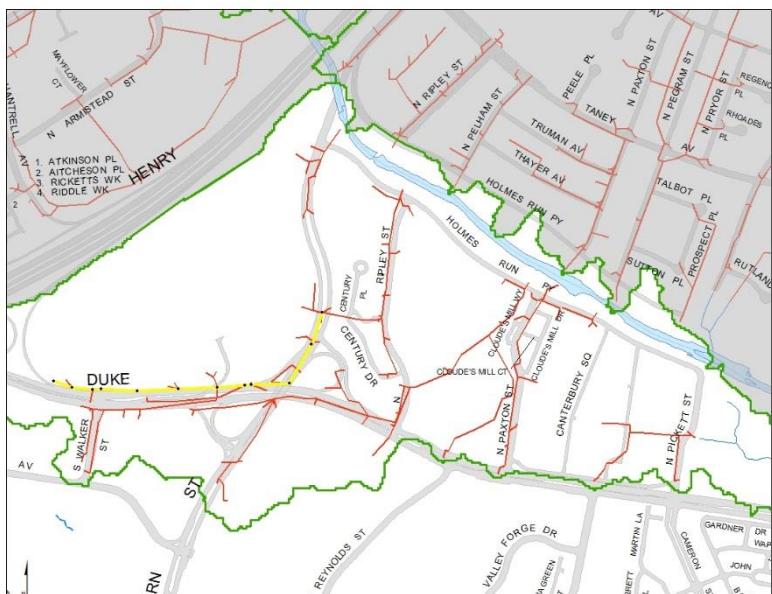
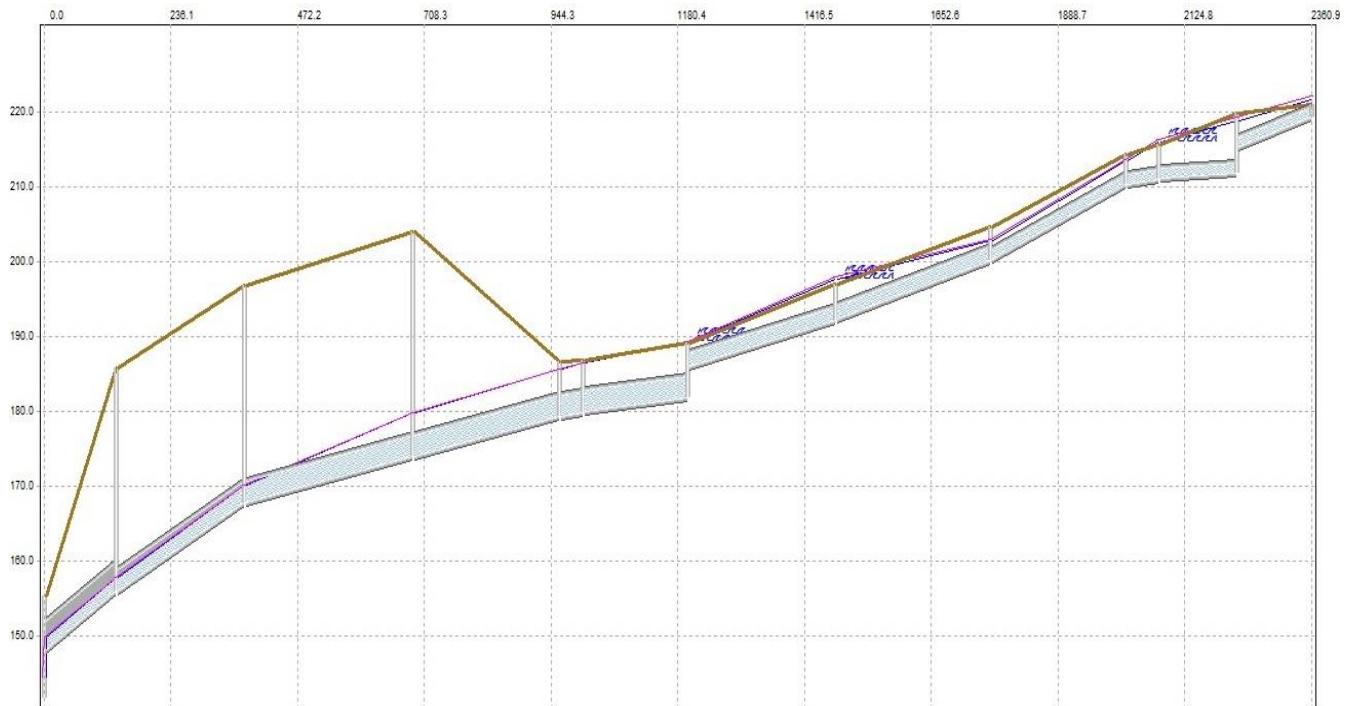


FIGURE 29

**Holmes Run Profile 29 from 000269IO to 003913IN**

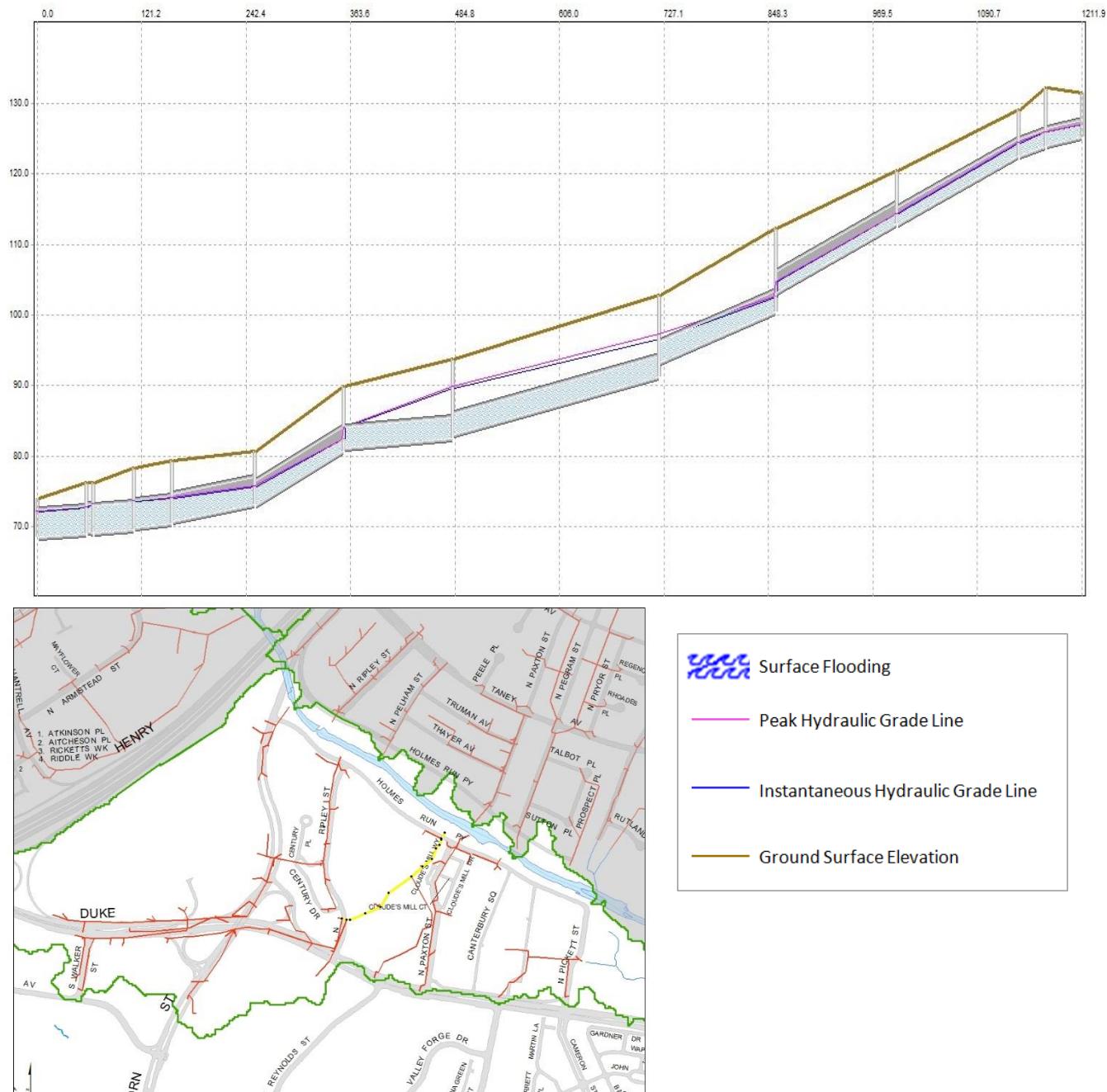


FIGURE 30

**Holmes Run Profile 30 from 003914IN to 001327SMH**

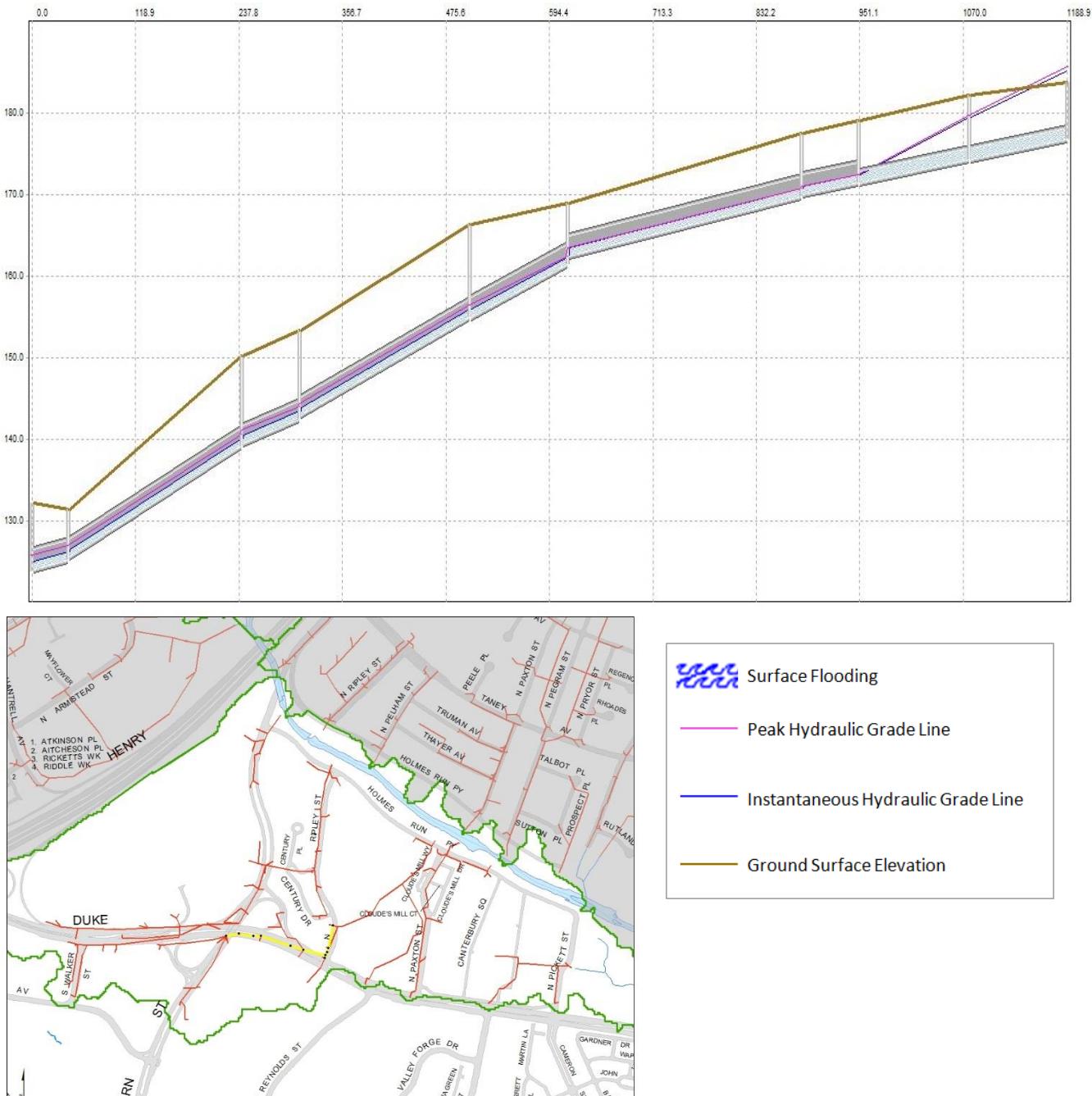
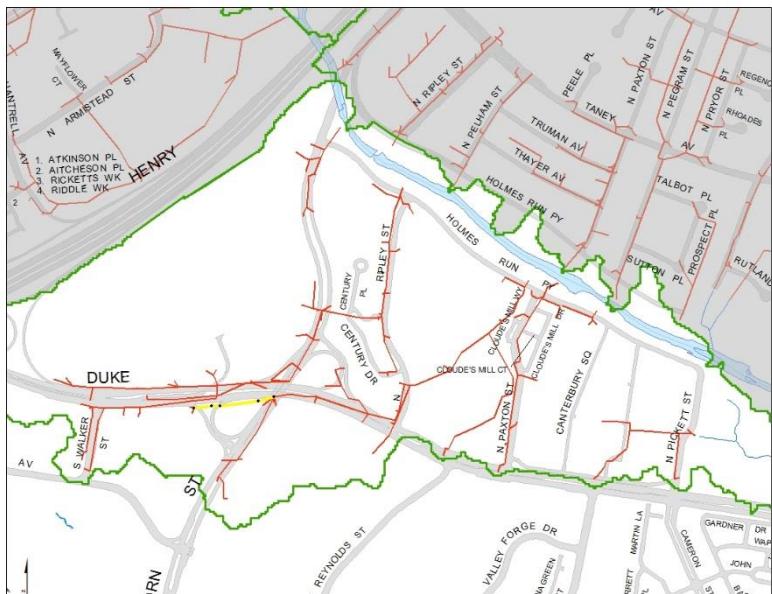
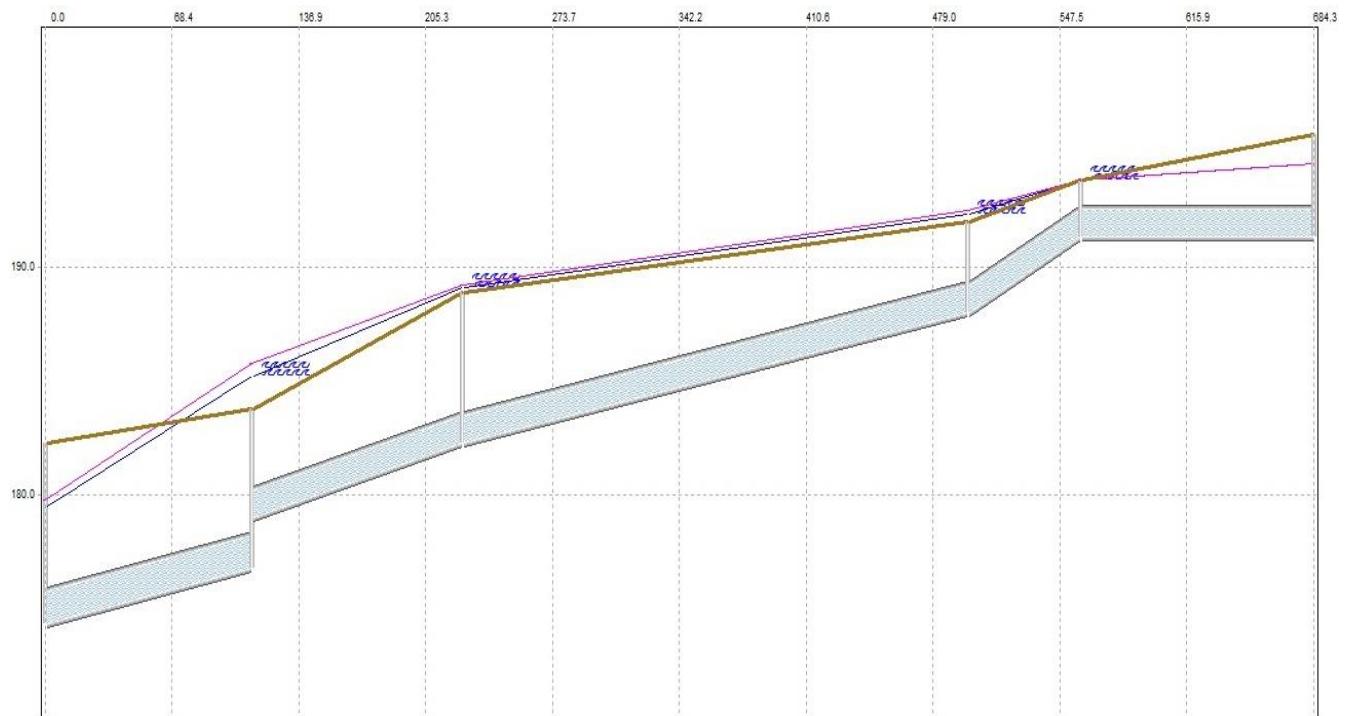


FIGURE 31

**Holmes Run Profile 31 from 001243SMH to 004239IN**



- Surface Flooding
- Peak Hydraulic Grade Line
- Instantaneous Hydraulic Grade Line
- Ground Surface Elevation

FIGURE 32

**Holmes Run Profile 32 from 000270IO to 001258SMH**

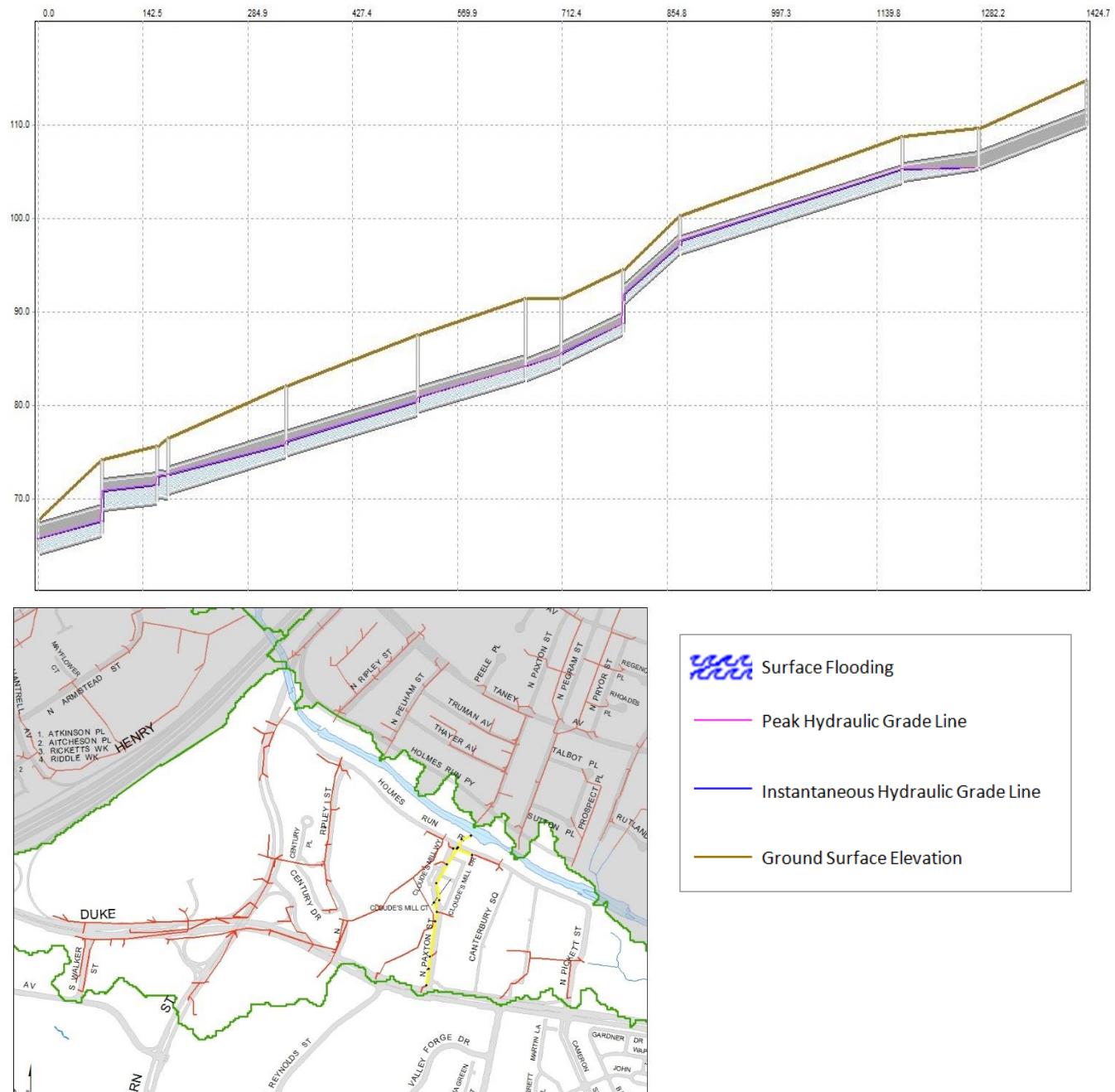


FIGURE 33

**Holmes Run Profile 33 from 000277IO to 003935IN**

